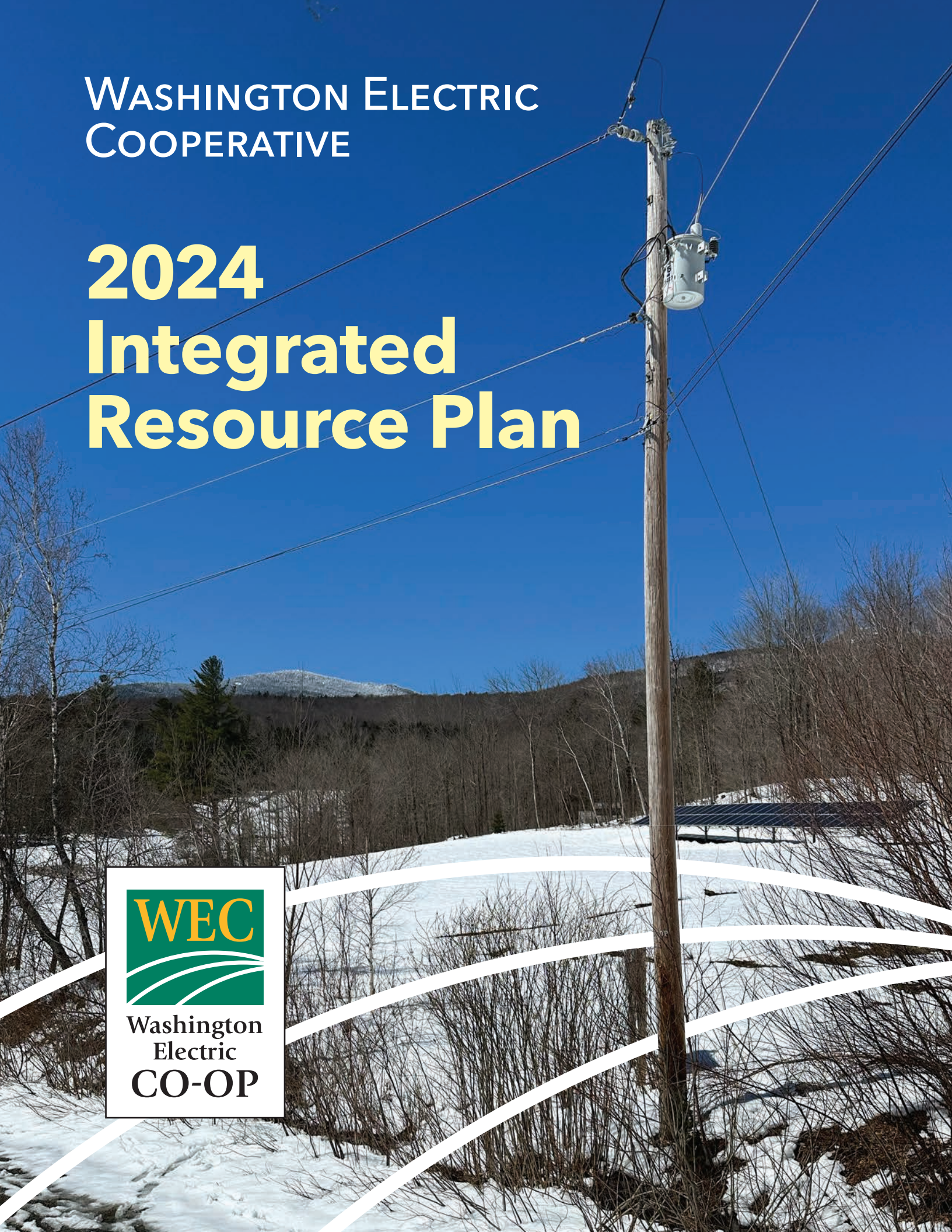

Washington Electric Cooperative

2024 Integrated Resource Plan

WEC
Washington Electric CO-OP

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P.O. Box 8
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www.washingtonelectric.coop

Washington Electric Cooperative

2024 Integrated Resource Plan

A note from WEC General Manager Louis Porter

WEC's Past and Future

Electrical power generation, delivery, and use nationwide are changing as significantly as they have at any time in the industry's history. Nowhere is that more true than in Vermont, and no Vermont utility is seeing the effects of those changes more than Washington Electric Cooperative.

From the rapid growth of individual members generating their own electricity through solar power, to significant infrastructure upgrades necessitated by the rise of renewable energy broadly, to increased demand due to the advent of heat pumps and electric vehicles, the 41 towns served by WEC are at the forefront of an energy revolution.

The historic challenges faced by many rural service providers remain as present in our part of Vermont as they have ever been. With fewer than nine members per mile and enough power lines to stretch from here to the state of Georgia, there are many costs to maintain our system with few to share in the bill. The people of our communities may be economically better off than they were 85 years ago when they banded together out of necessity to create their own utility, but there remain many who struggle to afford the high cost to remain in their homes—let alone to power their homes.

Fortunately, the principles on which the Co-op was founded remain a strong foundation to build an electrical utility prepared for the future. Those include democratic governance, transparency, environmental and social responsibility, and concern for community.

From becoming a fully renewable utility to its choice to stop contracting for nuclear power to its decision to generate most of the power its members use, WEC has led on questions of how to provide responsible electrical energy and will continue to do so based on the principles that led to WEC's formation. This Integrated Resource Plan charts the Co-op's course for the next 20 years as we work together toward a green energy future. We look forward to your questions and comments.

Sincerely,

Louis Porter

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Executive Summary

The Context

Washington Electric Cooperative is at a critical juncture in its history of service to Central Vermont communities.

Eighty-five years ago, WEC fired up its first fossil-fueled generator to send electric power to previously unserved homes and small farms. Now WEC's power supply is 100% renewable and does not include contracts for nuclear power. The original grid was built as a one-way street – from generation to load. Now electricity on WEC's network often flows back into the system from members' own generation, primarily solar panels. This energy revolution requires substantial new investment in infrastructure. At the same time, WEC and our member-owners face cost pressures.

The energy transition has also brought dramatic changes to demand. After years of declining load growth due to efficiency measures, WEC forecasts steady annual load growth as membership increases and member-owners increasingly use electricity to heat their homes and power their vehicles. Growth in membership during the COVID-19 pandemic was driven in part by residents who have moved to the territory from outside Vermont, or who now reside in what had been seasonal dwellings. Both new and long-standing members are more likely now to work and go to school from home, meaning outages have a larger impact on their lives than in the past.

The systems and technologies for energy use, generation, and distribution have also changed since the first half of the last century. What has remained constant is our rural nature and our members' modest incomes. In 1939, WEC committed to treating all its member-owners fairly while giving them a voice in shaping their energy future. That singular focus guides all our actions today.

In the 21st century, the Co-op became one of the first electric utilities in the country to secure 100% of its electricity from renewable sources. A commitment to renewable energy and addressing climate change is a central tenet of the Cooperative, reflecting what we believe are our members' values to work collectively to a more sustainable future for Vermont. As required by 30 V.S.A § 218c, Washington Electric Cooperative has prepared this 2023 Integrated Resource Plan (IRP) for submission to the Vermont Public Utility Commission and the Department of Public Service (DPS).

This IRP is a strategic plan that outlines how WEC will meet the public's energy needs safely, reliably, and at the lowest reasonable cost. We do this through a strategy that combines investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs.

The Department's Appendix B: Guidance for Integrated Resource Plans and 202 (f) Determination Requests defines the IRP's baseline requirements. IRPs are also required to be consistent with the state Comprehensive Energy Plan (CEP).

While this document meets these regulatory mandates, it also serves as a valuable tool to guide decision-making into the future. The IRP allows WEC to communicate with members and other stakeholders about power supply, demand side management, transmission and distribution system planning in the context of cooperative principles. The IRP covers a planning period of January 1, 2024 to December 31, 2043. It includes an Action Plan and is intended to be a working document.

WEC in 2024 confronts historic, industry-wide changes even as it faces more regulatory burdens, political pressure, and greater member expectations. This has occurred against the backdrop of a demographic shift, with our aging members living on fixed incomes while others work or go to school from home. Their needs and expectations for reliability have increased at the same time climate-caused storm damage has increased outages and made maintenance and upgrade work more difficult.

The Department of Public Service guidance for Integrated Resource Plans states: "Utilities should use the IRP process to address questions that are most relevant to the utility at the time of the IRP."

Foremost among the relevant issues for WEC are our cooperative principles of equity and shared community. We cannot allow the energy transition and its benefits to leave some

members behind, nor can we place the costs of that transition disproportionately on some members. This IRP charts WEC's course through this changing energy, regulatory, and demographic landscape.

The central elements of the IRP are the load forecast, the analysis of current and future resource needs, and the transmission and distribution upgrades required to meet them. We approach each of these issues with the overarching goal of maintaining affordability, reliability, and preventing unfair cost shifts between members while giving them autonomy in their energy options through electrification of heating and transportation. This plan also lays out a path for the Co-op that continues our early, groundbreaking work on bringing renewable energy to our members.

Key highlights:

- The load forecast (Section 3) prepared by our consultant Itron shows a steady increase in demand, with the winter peak expected to grow annually by 3.5% and the summer peak at 2.5%. Over the next two decades, WEC expects to meet its members' needs for affordable, reliable energy through existing power contracts, extensions of contracts, battery storage at the grid and in the home, plus potentially new resources that may be developed regionally (Section 4). WEC will likely use more power available under its Hydro-Québec contract and seek renewal of the contract for landfill gas produced in Coventry.

- Our modernization and innovation plan (Section 5) documents a measured course to incorporate the latest information technology into WEC's system, ranging from communication from substations and members' meters to battery storage and load management. These will be multi-year projects but will reap many benefits for WEC members including the ability to charge a home battery or vehicle at variable and favorable time-of-day (TOD) rates.

- WEC plans major upgrades to our distribution system, including hardening lines and replacing several substations. This is needed both to resolve the stress and thermal overload caused by increased distributed generation on our grid and to better withstand storm-caused power outages. Specifically, WEC plans to rebuild the Jackson Corner and Mount Knox substations, as detailed in the T&D section (Section 8.)

- WEC will integrate these improvements with new time-of-day (TOD) rates that will enable the Co-op and its members to best utilize beneficial electrification for heating and transportation. The decision analysis (Section 7) that we use to guide these investments and other capital improvements is shaped by our financial plan and debt forecast.

- WEC will continue to promote ways to get low- and middle-income members involved in the energy transition with incentives for electrification adoption, batteries in the home, and community solar. A main part of this strategy is a partnership with the Vermont Electric Cooperative (VEC) in the Affordable Community Renewable Energy (ACRE) Pilot that enables eligible members to participate in new Vermont solar projects, providing them discounts for five years.

- The Co-op will continue to advocate for changes in net metering reimbursement rates. This program has now become an unintended and financially costly consequence of our early embrace of member-owned and/or member-utilized distributed generation. As currently structured – and as detailed in this plan – the net metering program now shifts the cost burden between the members who can afford it to those who can't, while doing little to lessen our peak demand.

- Among the major challenges going forward are ongoing and increasing regulatory requirements to meet Vermont's social and energy policy goals. WEC estimates that it needs several full-time equivalent staff and contract positions to meet these regulatory burdens. This is a significant cost of doing business, particularly for a small utility which has most of the requirements as a larger one.

1. About Washington Electric Cooperative

Washington Electric Cooperative was established in 1939 as a not-for-profit, member-owned rural electric utility. The Co-op was organized at the height of the Great Depression as a means to bring electric service to 150 farms and homes in Washington County.

Vermont's investor-owned utilities saw little profit or potential in this hilly farm country. As Gov. George Aiken noted at the time, "Their motive seems to be to get the last drop of blood at as little expense to themselves as possible. Therefore, they lack the desire to serve thinly populated rural areas and apparently they cannot see the possibilities for future development."

The Co-op's founders 85 years ago were familiar with cooperative concepts and benefits. Many marketed their milk through dairy cooperatives or shopped at a cooperative store. E. Harmon Kelley, WEC's first president, touched on these core cooperative principles at a celebration when lines were first energized in December 1939.

"Those of us who have participated in the benefits of the Cooperative store at Adamant and Plainfield realize the happy results from communities working together for a common cause," Kelley said.

1.1 WEC Service Territory

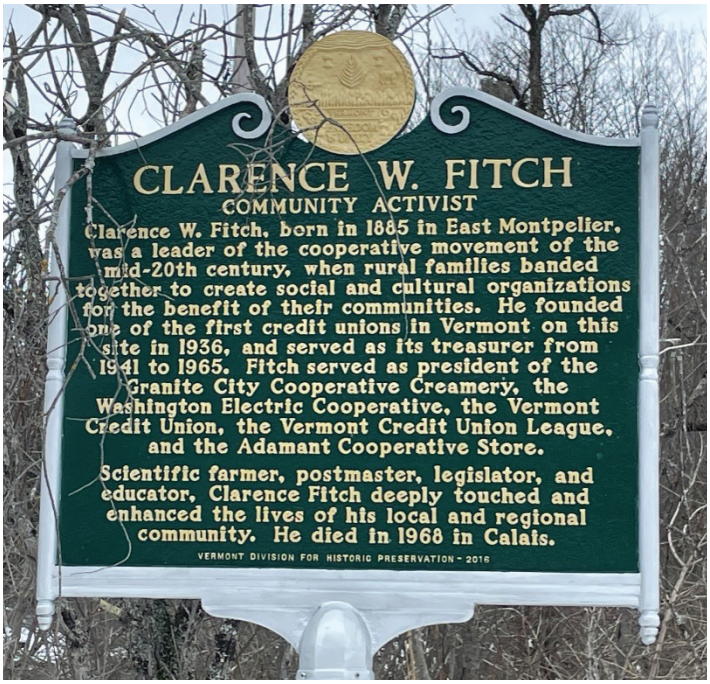
The Co-op's sparsely populated, geographically dispersed territory shaped its beginnings and remains its biggest challenge. WEC has the least dense system of any Vermont utility, with fewer than nine members per mile.

Although many of the original dairy farms are gone, the Co-op's territory today remains overwhelming rural. WEC's approximately 12,000 members are spread over 2,728 square miles in 41 towns that span four counties. The customer class served by the Co-op is predominantly residential, comprising 94% of the meters on the system. Approximately 690 members, or just 6%, are in the small commercial class. The Co-op has 13 large commercial customers, four of which are part of net metering groups.

Many members live along unpaved roads. The Co-op's lines also run along those roads, but a significant portion do not. These lines cut "cross lots" through rugged and challenging terrain, a vestige of WEC's foundational mission to connect farms and homes to life-changing electricity. Although WEC has worked hard to move more of its service to roadsides, those cross-lot lines are particularly difficult

Gov. George Aiken throws the switch to energize the Co-op's lines in 1939.

Source: WEC



The Vermont Division of Historic Preservation honored our region's role in the cooperative movement with this sign adjacent to the Adamant Cooperative, the oldest continuously operating food co-op in the United States.

and expensive to clear and repair during this century's increasing storm events.

The Co-op's system is costly to maintain, with roughly $3 million spent in 2023 on storm restoration, clearing rights-of-way, and maintaining overhead lines. Because of the low density of the population served, WEC has relatively few member-owners to cover these costs.

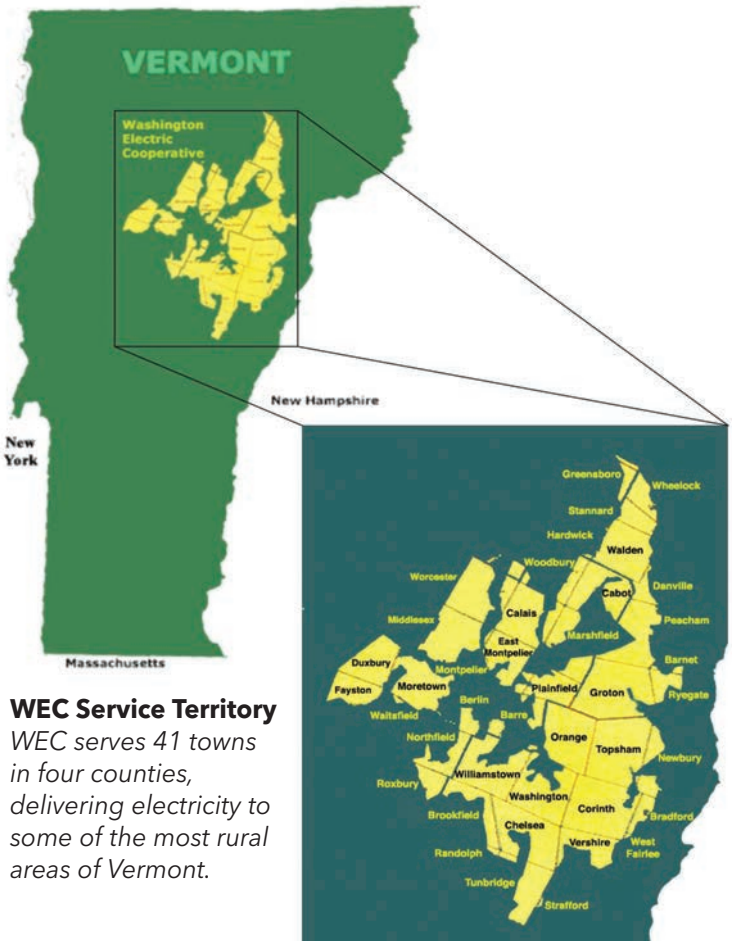
1.2 Organization Governance, Member Benefits, and Cooperative Principles

The International Cooperative Alliance defines a cooperative as "an autonomous association of people united voluntarily to meet their economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled business."

Electric cooperatives were formed in the early part of the 20th century to serve rural areas that were not profitable to supply with electricity. The federal government provided support through the Rural Electrification Act of 1936, and volunteers formed cooperatives to bring electricity to previously unserved areas. Cooperatives around the world operate based on a core set of principles that trace their roots back to Rochdale, England in 1844. The seven cooperative principles are:

- Voluntary and open membership
- Democratic member control
- Member economic participation
- Autonomy and independence
- Education, training and information
- Cooperation among cooperatives
- Concern for community

Figure 1-1. WEC Service Territory



WEC Service Territory
WEC serves 41 towns in four counties, delivering electricity to some of the most rural areas of Vermont.

WEC's mission to serve its members with safe, reliable, and affordable electric power and energy services has remained unchanged since 1939. Cooperative principles of equity and fairness guide WEC's decision making. WEC must ensure that the benefits of the transition to a cleaner, more efficient energy system are realized by all members and do not unfairly burden those who cannot afford heat pumps, solar panels, or electric vehicles, despite the various incentives available. WEC commits through its cooperative mission in the following ways:

- **Renewable Power** – Maintaining a 100% renewable energy portfolio in a time of increasing demand.
- **Financial Health** – Balancing investments with rates.
- **Innovation** – Deploying modern utility infrastructure and equipment to aid reliability and speed decarbonization.
- **Energy Equity** – Fairly distributing benefits and costs among WEC members.
- **Grid Resiliency** – Maintaining a safe and reliable grid that can manage distributed generation and more severe weather damage.
- **Transparency** – Keeping its member-owners informed about their Co-op and its business, economic, regulatory, political, and social environments.

- **Environmental protection** – Minimizing the impacts of electric generation and our operations.
- **Community** – Supporting and promoting our local economy and community organizations.
- **Advocacy** – Providing leadership and speaking out on energy and environmental issues.

As a member-owned cooperative, WEC is a democratic organization responsible to and controlled by its members. Member-owners elect a governing board from among themselves to oversee management of the Co-op's business and to set WEC policy and strategy. At each annual meeting, three directors are elected to serve a term of three years. The board holds regular monthly meetings that are open to members.

Members not only have a vote on certain policy decisions, but they also have a direct, financial stake in the Cooperative. The Cooperative belongs to the communities it serves, and collectively our staff and board have a deep commitment to

THESE ARE THE WORDS WE LIVE BY.

1 VOLUNTARY AND OPEN MEMBERSHIP

Membership in a cooperative is open to all persons who can reasonably use its services and stand willing to accept the responsibilities of membership, regardless of race, religion, gender or economic circumstances.

2 DEMOCRATIC MEMBER CONTROL

Cooperatives are democratic organizations controlled by their members, who actively participate in setting policies and making decisions. Elected representatives (directors/trustees) are elected from among the membership and are accountable to the membership. In primary cooperatives, members have equal voting rights (one member, one vote); cooperatives at other levels are organized in a democratic manner.

3 MEMBERS' ECONOMIC PARTICIPATION

Members contribute equitably to, and democratically control, the capital of their cooperative. At least part of that capital remains the common property of the cooperative. Members allocate surpluses for any or all of the following purposes: developing the cooperative; setting up reserves; benefiting members in proportion to their transactions with the cooperative; and supporting other activities approved by the membership.

4 AUTONOMY AND INDEPENDENCE

Cooperatives are autonomous, self-help organizations controlled by their members. If they enter into agreements with other organizations, including governments, or raise capital from external sources, they do so on terms that ensure democratic control as well as their unique identity.

5 EDUCATION, TRAINING AND INFORMATION

Education and training for members, elected representatives (directors/trustees), CEOs and employees help them effectively contribute to the development of their cooperatives. Communications about the nature and benefits of cooperatives, particularly with the general public and opinion leaders, helps boost cooperative understanding.

6 COOPERATION AMONG COOPERATIVES

By working together through local, national, regional, and international structures, cooperatives improve services, bolster local economies and deal more effectively with social and community needs.

7 CONCERN FOR COMMUNITY

Cooperatives work for the sustainable development of their communities through policies supported by the membership.

THE SEVEN COOPERATIVE PRINCIPLES

The National Rural Electric Cooperative Association (NRECA) is the national service organization for more than 900 not-for-profit rural electric cooperatives and public power districts providing retail electric service to more than 42 million consumer-members in 48 states and whose retail sales account for approximately 12 percent of total electricity sales in the United States.

Learn more at **electric.coop**

NRECA
America's Electric Cooperatives

our members and the communities they live in.

Members can participate and share in WEC in several ways:

- **Vote on long-term power supply contracts:** Under Vermont statutes regulating electric cooperatives, WEC in certain situations is required to hold a vote of the membership before instituting large and long-term contracts for power generated outside the state. These are defined as contracts of five years or longer, and for power that would constitute more than 3% of WEC's peak demand, and which is not from renewable sources of power.
- **Vote on major capital expenditures for generation and transmission facilities:** WEC must ask its members' approval of plans to build and construct generating stations and to make major capital expenditures on new transmission facilities. The Coventry facility, which is fueled by landfill methane that would otherwise be flared and which now provides two-thirds of WEC's power supply, is an example in which members voted to invest in a major capital expenditure.
- **Attend board meetings:** Meetings of WEC's Board of Directors are generally held on the last Wednesday of each month, at the member services office off Route 14 in East Montpelier. Meetings are open to members.
- **Run for the board:** Any qualified member can join the board if voted in by the membership. Serving on the Board of Directors allows a member to shape policy and organizational decisions of the Co-op and serve the needs of the entire membership.
- **Receive capital credit distributions:** Washington Electric Cooperative is a not-for-profit company. In years when the Co-op's revenues exceed its expenses, those excess dollars, or "margins," are assigned to capital credit accounts held in each WEC member's name. These are bookkeeping entries, not actual cash accounts. In 1998, WEC became the first electric co-op in the state to begin disbursements of money (referred to as retirements) to its members, based on values documented in their capital credit accounts. With some alteration – the disbursements for most people now take the form of credits on their November electric bill – the Cooperative has continued that practice every year since.

In total, WEC has returned $9,697,000 to its members since 1998. WEC's annual retirements are summarized in Table 1-1. Each year, members see a reduction in their electric bills that can help offset the impact of years WEC must increase rates. The return of capital credits is unique to the co-op model and is a way to reinforce the ownership value in a member-owned utility. Neither municipal nor private utilities in Vermont return dollars to their rate base in the form of annual credits or checks.

Table 1-1.
Capital Credit Retirements

Year	Funds Returned
1998	$ 273,000
1999	$ 231,000
2000	$ 200,000
2001	$ 200,000
2002	$ 200,000
2003	$ 200,000
2004	$ 200,000
2005	$ 275,000
2006	$ 275,000
2007	$ 275,000
2008	$ 325,000
2009	$ 275,000
2010	$ 273,000
2011	$ 275,000
2012	$ 275,000
2013	$ 275,000
2014	$ 300,000
2015	$ 350,000
2016	$ 460,000
2017	$ 720,000
2018	$ 750,000
2019	$ 750,000
2020	$ 770,000
2021	$ 770,000
2022	$ 400,000
2023	$ 400,000
Grand Total	**$9,697,000**

1.3 Communicating with Members, Member Survey

WEC keeps its members informed about Co-op decisions, new policies, and new services available to members through a newsletter, *Co-op Currents,* that is published six times a year. The Co-op website maintains a digital archive of past issues. It also publishes these and other articles through a digital edition of *Co-op Currents* and on its website.

Every five years, the Co-op also conducts a comprehensive survey of members to learn about the member's satisfaction with Co-op services and to find ways to improve our business.

The last survey, done in 2020, found that overall satisfaction with WEC is good, with a mean rating of 8.34 on a 10-point scale. Of the nine attributes of service tested, members indicate that "providing reliable service," "having competent/knowledgeable employees," "providing good value," "having friendly/courteous employees," and "handling individual complaints and problems" are most important to them.

The attributes for which the Co-op fared least well, with mean performance ratings below 8.00, were "helping members learn to manage their energy use," providing "a good value for the money spent," and "looking out for members' best interests."

Two-thirds of members feel it is very important that WEC provides them with renewable energy sources. Just over half say they would definitely or probably use a time-of-day rate if available. This was significantly higher than in 2015.

The survey offers more than mere data points. It helps guide where WEC needs to focus for improvements, particularly in improving reliability and delivering members value for the money they spend on their electric bills.

WEC also communicates with members every day, whether that is about an additional service or service upgrade, an outage, or questions about a bill. While these communications are frequent, substantive and largely positive, we have not categorized or analyzed these in an organized and sustained way. Given electronic communications and record keeping, doing so may be a

way to turn anecdotal information into actionable data in the future, particularly when combined with additional meter and other kinds of member information.

1.4 Community Fund

To fulfill the seventh cooperative principle of "concern for community," WEC in 2003 established a Community Fund that annually makes modest contributions to local non-profit organizations and community projects.

WEC cannot and does not pay for these contributions from its operating budget. Instead, WEC asks its members to voluntarily donate their capital credit refunds to the WEC Community Fund. (Members choosing not to participate in the Community Fund receive their refunds in November.)

After the disastrous flooding that hit central Vermont in July 2023, WEC shifted the fund's focus to quickly respond with flood relief efforts. WEC invited area nonprofits that serve members in WEC's 41 towns to submit grant applications for help with damage the nonprofits themselves may have suffered. The application process was streamlined and donations were limited to $1,000 apiece. In all, about 16 area nonprofits, including the Barre Community Justice Center, Twin Valley Senior Center, Montpelier Alive, and others, were given aid.

Table 1-2.
Community Fund Donations

Community Fund Donations by Year	
2004	$ 7,980.00
2005	$ 16,767.24
2006	$ 20,414.75
2007	$ 26,214.03
2008	$ 20,514.52
2009	$ 19,689.66
2010	$ 21,498.52
2011	$ 23,373.93
2012	$ 18,234.60
2013	$ 19,582.74
2014	$ 21,159.13
2015	$ 22,712.81
2016	$ 25,601.97
2017	$ 38,464.96
2018	$ 45,589.09
2019	$ 54,425.61
2020	$ 47,100.00
2021	$ 33,150.00
2022	$ 32,250.00
2023 (Through August)	$ 42,400.00
2023 quarters 3 & 4 paid in 2024	
Total Donated	**$ 557,123.56**

1.5 Membership Demographics and Energy Burden

WEC's members pay the highest retail electricity rates in Vermont due to a number of factors. As noted, the Co-op faces the relatively steep cost of maintaining the distribution network. It lacks large industrial users on which to spread those costs. While the Co-op owns cost-effective generation sources such as its Coventry plant, WEC also relies on the regional wholesale electricity market, over which it has little control.

As the Public Utility Commission noted in May 2023, the regional market is impacted by forces far beyond New England.

"WEC is requesting a rate increase primarily due to rising power supply costs and increases in operating costs. Geopolitical circumstances, such as the Russian invasion of Ukraine, have caused supply shortages and price increases to oil and natural gas. A large percentage of power plants in New England are fueled by oil and natural gas, and WEC is directly affected by these increased prices through its participation in the ISO New England markets." PUC order approving 12.83% increase, May 19, 2023

Energy burden is defined as the percentage of gross household income spent on energy costs, including heating or cooling (thermal), transportation, and electricity.

The American Council for an Energy Efficient Economy (ACEEE) found that across all nine census regions of the

Figure 1-2. 2023 Sources and Costs of Power
(Total kWh Purchased and Generated)

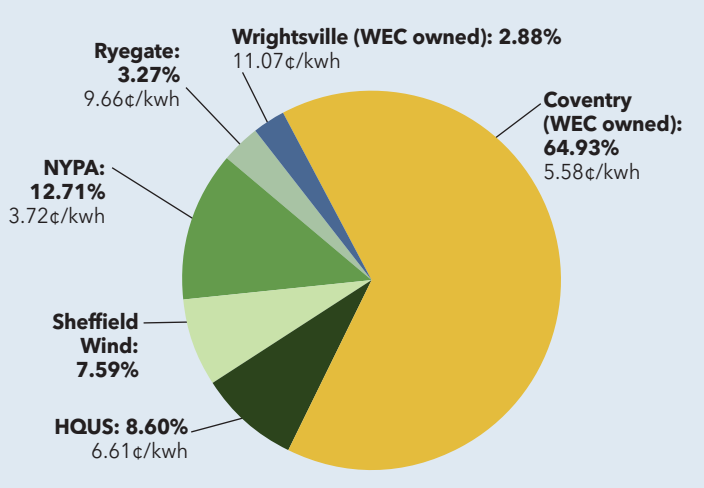
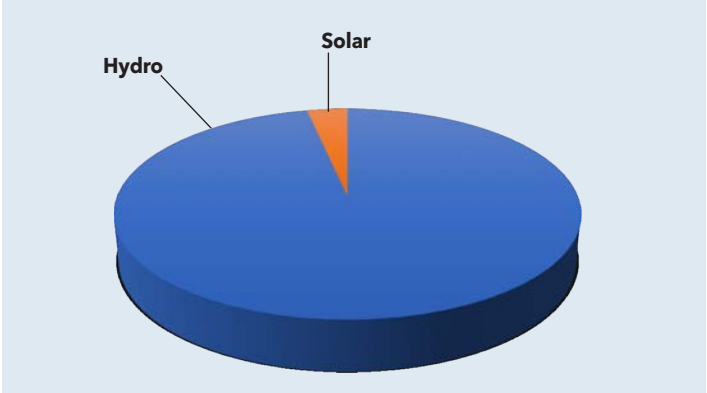


Figure 1-3.
WEC Resource Mix, Post REC Transactions



country, low-income household energy burdens are 2.1–3 times higher than the median energy burden. The gap between low-income and median energy burdens is largest in the New England, Pacific, and Mid-Atlantic regions (3.0, 2.9, and 2.8 times higher, respectively).

The energy burden in Vermont is higher than the national average, according to the ACEEE [https://www.aceee.org/sites/default/files/pdfs/u2006.pdf].

Moreover, the rural nature of the Co-op's territory increases the overall energy burden of its members.

With public transportation lacking in many of the towns, commuting to work is costly in an era of escalating fuel prices. The region's housing stock – particularly in the most rural areas served by the Co-op – is old and often less well-insulated and more expensive to heat.

Vermont Energy Investment Corporation, through its Efficiency Vermont utility, calculated the energy burden of towns in Vermont as a percentage of household median income spent on total energy needs, including heating, transportation, and electricity. Communities served by the Co-op have relatively high energy burdens compared to the state as a whole.

The 2023 Energy Burden Report finds the average Vermont household energy burden is 11%. About half of that spending (45%) is for transportation. Heating, or thermal energy, accounts for another 35%, with 20% for electricity. On average, it all adds up to more than $7,000 in energy spending annually.

According to the U.S. Department of Energy's Low-Income Energy Affordability Data (LEAD) Tool, the national average energy burden for low-income households is 8.6%, three times higher than for non-low-income households, which is estimated at 3%.

Energy expenses, of course, are just one of the escalating costs faced by Vermonters. Housing prices, for example, have more than doubled in a decade and rose 15% in 2022 alone, according to data from the Vermont Housing Finance Agency.

The energy burden for people with lower incomes is also magnified by the cost barrier to achieve energy savings. Because these households have limited discretionary income and often have older, less-efficient housing stock and appliances that lead to higher energy bills, low-income households devote a greater proportion of their income to paying energy bills. While it is sometimes erroneously assumed that lower-income households use less electricity, that is far from always the case for the reasons mentioned above. Given this, reducing excess energy use in low-income households is critical for addressing energy insecurity.

The EVT 2023 report uses data primarily from 2017-2021. It provides energy burden analysis at the town level, finding the most-burdened communities are in rural areas and in the Northeast Kingdom.

For example, in WEC territory, the energy burden in Plainfield is 14.3%. In Chelsea it is 12.3%, and in Wheelock, residents pay 11.2% of their income on energy needs.

Figure 1-4. Energy Burden

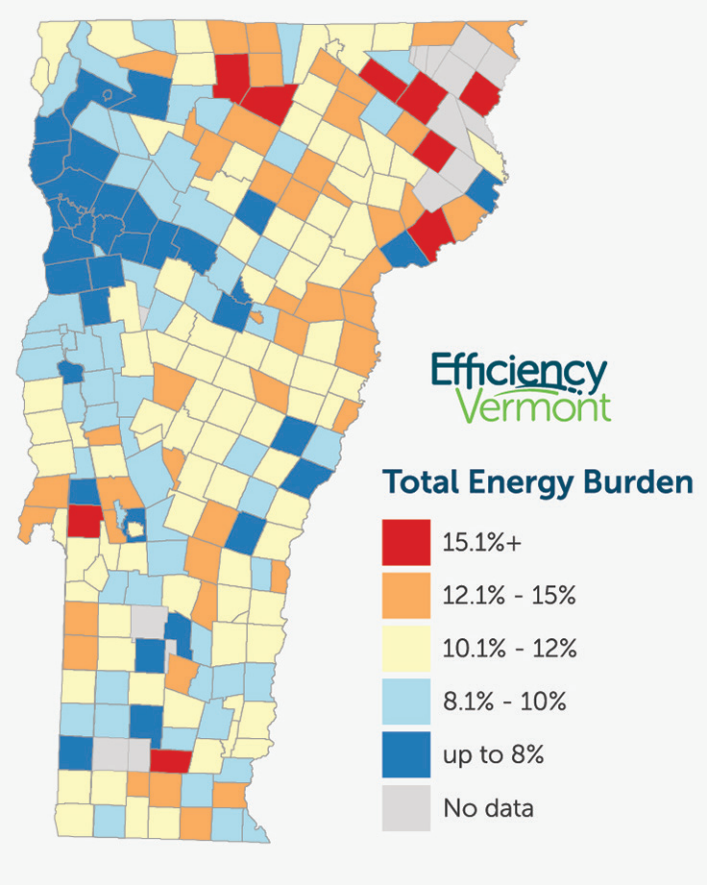


Figure 1-5. Electricity Burden By Town

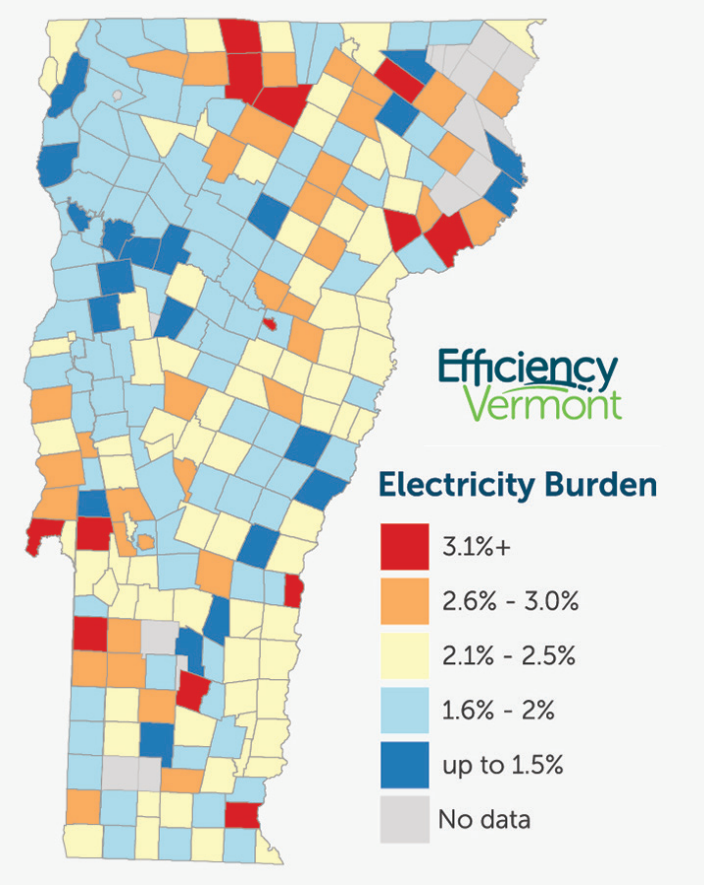
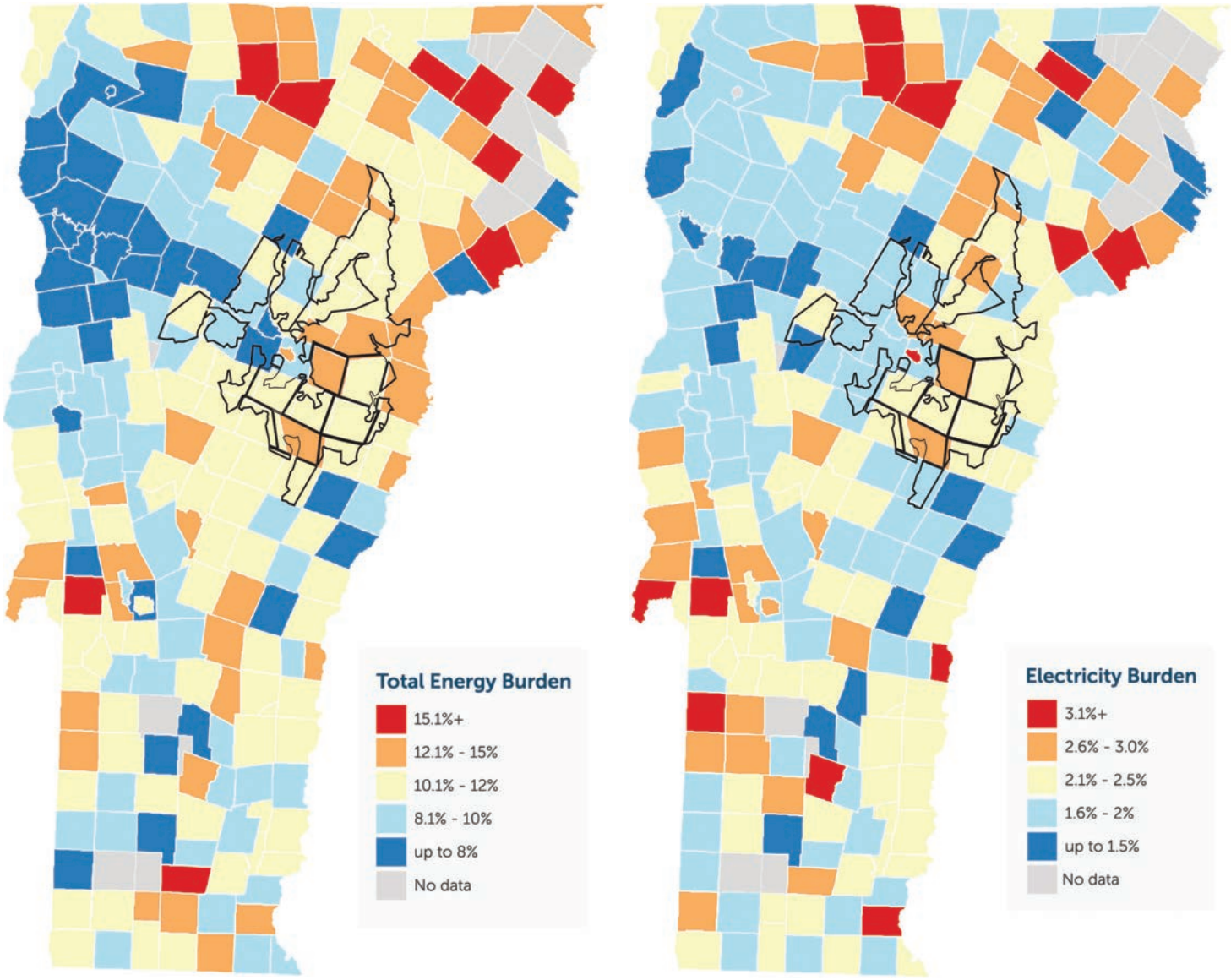


Figure 1-6. Total Energy and Electricity Burdens As Seen With WEC 's Territory Delineated



Although the town energy burden data from Efficiency Vermont is informative, calculating the exact energy burden throughout the Co-op's territory is difficult because even at the local level, many towns have villages served by Green Mountain Power, while the more rural areas of those communities are served by WEC. When weighted for population and Co-op membership, an average energy burden of 13% was arrived at for the Co-op's territory, compared to 11% for the average Vermont household. Given that the Co-op does not seek or maintain income information about its members and instead uses third party verification for programs requiring this information, energy burden has been the primary way the Co-op has identified which customers may be vulnerable to financial pressures.

To address this issue, the Co-op works with Efficiency Vermont and Capstone Community Action to target efficiency and weatherization programs aimed at reducing overall energy costs to lower-income members. As detailed in Section 7, WEC designs its Tier III annual plan, within the Renewable Energy Standard, to focus on energy efficiency first through the Button Up WEC program. The Co-op also offers a coordinated set of incentives for heat pumps, home water heating, and other technologies to help members use less energy overall and to shift to beneficial electrification.

1.6 Member Growth and Increase in Sales

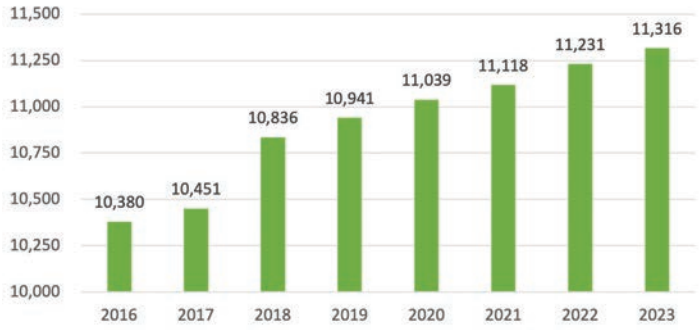
The Co-op has experienced relatively strong growth in the number of residential members, averaging 0.9% annually between 2013 and 2022.

WEC is one of a few utilities in Vermont that has seen positive sales growth in recent years. From a low of 65,420 MWh in 2016, WEC sales have grown annually to a total of 74,017 MWh in 2022. COVID-19 had a muted impact on total sales for the Co-op, as the loss in commercial sales was more than offset by an increase in residential sales.

After years of decline due to efficiency measures, member usage has begun to increase year over year both in total and on average across the membership, due in large part to the penetration of beneficial electrification and changes to members usage patterns since the COVID-19 stay at home orders.

WEC's total annual load is predicted to increase significantly over the next 20 years as beneficial electrification drives demand, pushing expected energy requirements to average 2.5% annual growth. This compares with baseline annual sales increase of 0.1%. Winter-adjusted peak averages 3.5% annual demand growth, and summer, 2.5% annual growth. WEC remains a winter peaking utility throughout this forecast period. [For more detail, see Section 3: Load Forecast.]

Figure 1-7.
Number Of Residential Customers Served



Source: Form 7. This shows residential members only. In 2023, WEC also has members in the small commercial (686) and large commercial (13) classes.

1.7 WEC's Place in the Electricity Sector

WEC is one of 18 distribution utilities in Vermont, including the Global Foundries self-managed utility that serves the former IBM plant in Essex. Vermont Electric Power Company, Inc. (VELCO) manages all transmission resources in the state. The Federal Energy Regulatory Commission (FERC) governs most hydroelectric facilities, along with gas bulk transmission and generation assets in the U.S. and cross-border transmission connections with Canada.

WEC participates and operates in the New England wholesale power markets administered by the Independent System Operator of New England (ISO-NE). The ISO-NE is responsible for reliability of the regional power grid covering all six New England states, including Vermont. That grid includes more than 300 separate generating plants and more than 8,000 miles of transmission lines—all interconnected and dedicated to ensuring reliability of the New England region.

The Cooperative, like all other electric utilities in New England, relies on the ISO-NE to dispatch generation and settle load obligations in the New England power markets. The Cooperative relies

Figure 1-8. Average Monthly KWh Sales

Source: Form 7

Table 1-3. WEC Historical Calendarized Billed Sales And Members

Customers and Sales										
Year	Res Sales (MWh)	Chg	Res Custs	Chg	Res Avg Use (kWh)	Chg	Non-Res Sales (MWh)	Chg	Total Sales (MWh)	Chg
2013	60,244		10,294		5,852		7,842		68,086	
2014	60,474	0.4%	10,291	0.0%	5,876	0.4%	7,792	-0.6%	68,266	0.3%
2015	58,531	-3.2%	10,325	0.3%	5,669	-3.5%	8,173	4.9%	66,704	-2.3%
2016	56,539	-3.4%	10,346	0.2%	5,465	-3.6%	8,881	8.7%	65,420	-1.9%
2017	59,691	5.6%	10,418	0.7%	5,730	4.8%	8,763	-1.3%	68,454	4.6%
2018	60,038	0.6%	10,798	3.6%	5,560	-3.0%	8,809	0.5%	68,847	0.6%
2019	61,594	2.6%	10,882	0.8%	5,660	1.8%	8,721	-1.0%	70,315	2.1%
2020	63,017	2.3%	10,976	0.9%	5,741	1.4%	8,272	-5.2%	71,289	1.4%
2021	64,607	2.5%	11,076	0.9%	5,833	1.6%	8,543	3.3%	73,150	2.6%
2022	65,314	1.1%	11,165	0.8%	5,850	0.3%	8,703	1.9%	74,017	1.2%
2013 - 2022		0.9%		0.9%		0.0%		1.2%		1.0%

upon ISO-NE to maintain reliability of the bulk power system and to administer the electricity markets within New England.

Through its joint ownership in VELCO and under the Cooperative's participation in the Central Dispatch Agreement (CDA) with the Vermont Public Power Supply Authority (VPPSA), the Cooperative is a member of the New England Power Pool (NEPOOL). The Cooperative's power supply resources are combined in the CDA with other VPPSA participants, and settled as one entity with ISO-NE. The CDA is intended to provide savings to VPPSA members by taking advantage of economies of scale through sharing staff resources. Under the CDA, all participants' supply sources and loads are aggregated into one entity for ISO-NE settlement calculations.

The Cooperative became a member of the CDA effective July 1, 1998. The Cooperative can withdraw from the arrangement on short-term notice (30 days, including any additional time required by ISO-NE to reflect such a change).

Over the past decade, the ISO-NE market structure has continued to evolve. Spot markets for energy, capacity, and ancillary power products were developed, upon which New England utilities such as the Cooperative depend to achieve reliability of the bulk power system. In recent years, significant investments in transmission in the ISO-NE region have contributed to increased transmission costs for the Cooperative and other utilities.

Transmission congestion in the Sheffield-Highgate Export Interface area, or SHEI, has financial ramifications for powergeneratedfrom Sheffield Wind and Coventry to be exported to areas of power demand in the rest of Vermont and New England. While ISO-NE has not curtailed Coventry directly by requiring a partial or complete shut-down, it has altered price signals during these periods. ISO-NE's management of congestion cost WEC $140,949 in 2022 and $15,621 in 2023. This is expected to be ongoing, and even exacerbated by additional generation being added in the SHEI area.

In 2023, the Cooperative's energy settlement load obligation with the ISO-NE, plus internal generation, was 79,212 MWH. This value represents the Cooperative's retail sales, distribution and transmission losses, unbilled accounts, and internal generation. To hedge its load obligation, the Cooperative's power sources in 2023 totaled 79,682 MWH.

The ISO-NE has three primary responsibilities:

- **Reliability:** Minute-to-minute reliable operation of New England's bulk electric power system, providing centrally dispatched direction for the generation and flow of electricity across the region's interstate high-voltage transmission lines and thereby ensuring the constant availability of electricity for New England's residents and businesses.
- **Cost-effective Markets:** Development, oversight, and fair administration of New England's wholesale electricity marketplace, through which bulk electric power has been bought, sold, and traded since 1999. These competitive markets provide market based economic and environmental outcomes for consumers.
- **Planning:** Management of comprehensive bulk electric power system and wholesale markets' planning processes that address New England's electricity needs well into the future.

The New England power market consists of:

Spot Energy Markets

Fuel prices, primarily natural gas, and supply and demand conditions in the New England power markets determine the wholesale market price for electricity. Regional conditions and markets affect the cost of other power requirements, including capacity and ancillary services. Consequently, the economic operation of any supply resource that WEC might consider as part of its future supply portfolio is a function of conditions in the wholesale fuel and electric generation markets.

Hourly Locational Marginal Prices (LMPs) are developed and published by ISO-NE for energy delivered at specific points, or "nodes," on the electric system where generation or load interties with the bulk power grid. LMPs for each node are established for two energy markets operated by ISO-NE: day-ahead and real-time.

These markets are designed with the goal to achieve efficient economic dispatch of the regional generation fleet, subject to transmission security protocols and/or constraints. Each generating unit providing energy to the spot market at a given location (e.g., at the generator bus, or delivered into pool transmission facilities), in a given hour, receives a clearing price based on the LMP at that location. In general, the LMP reflects the bid price(s) of the most expensive source(s) providing energy to that location in that hour. Under this market structure, generation suppliers have incentive to bid at or near their short-run variable costs of providing energy.

ISO-NE Markets–Multi-Settlement System

The ISO-NE market system is a "multi-settlement" system, meaning there are separate settlements between ISO-NE generators and load-serving entities (LSEs). Specifically, ISO-NE pays generation based on nodal, hourly LMPs specific to their locations. In separate transactions with load-serving entities, ISO-NE charges load based on the aggregation of nodal LMPs into zonal averages, depending on what state, or section within a state, the load resides. Therefore, all generation is paid and all load is charged for various markets and services to provide reliability of the grid.

The market is geographically segmented for pricing wholesale electricity relative to load. Pricing zones are established by state boundaries, and in some cases, further refined due to transmission constraints that limit the free flow of power between locations within a given state. There are eight ISO-NE energy pricing zones, or load zones: one each for Vermont, New Hampshire, Maine, Rhode Island, and Connecticut, and three within Massachusetts.

The economics of WEC's net cost to serve load are based on charges it incurs for load and credits it receives for its various supply resources. Therefore, WEC's costs depend specifically upon the Vermont zonal LMP average, which is charged to WEC load, as well as other products from ISO-NE administered markets. However, these costs are offset by revenues received for WEC's supply resources based on specific nodal LMPs, wherever they are located, and other market credits for power sources.

Regional Energy Prices Modeling and the New England Energy Market

The energy market is the largest component of wholesale power costs in New England, accounting for approximately 50% of the total cost of charges incurred by WEC for energy, capacity, and ancillary service charges in 2023. ISO-NE also levies a "self-funding" tariff to cover administrative services. In 2023, this accounted for approximately 2% of costs.

Regional Network Load (RNL) Costs

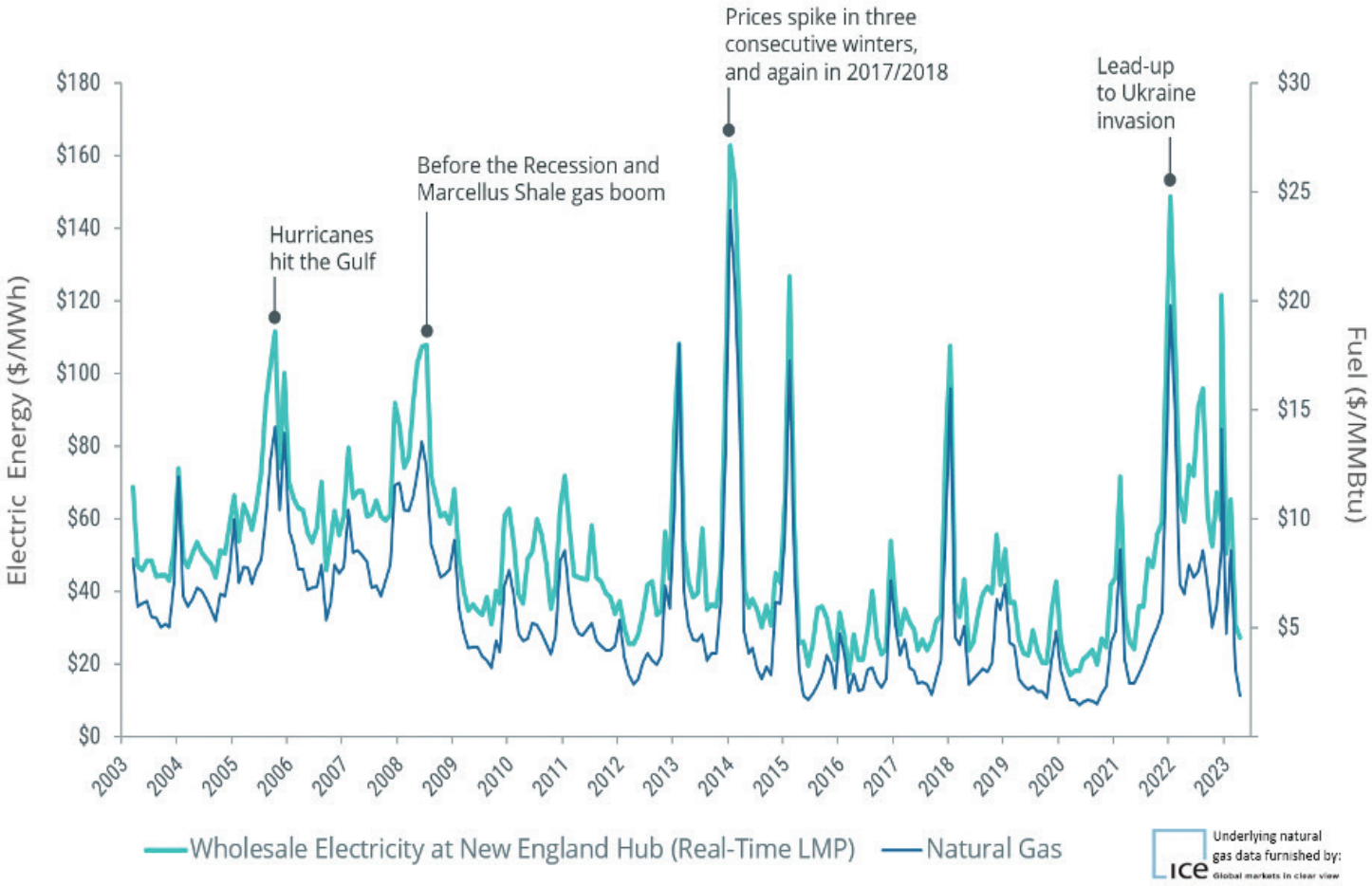
In 2023, Regional Network Load Costs were 32% of total costs of load. These charges represent the costs of transmission facilities, charges for reliability, and certain ISO-NE administrative services. Of the three cost categories included in RNL (infrastructure, reliability, and administrative), infrastructure costs make up over 90%. RNL costs have risen in recent years as a result of investment in new transmission infrastructure, upgrades to existing infrastructure, operating and maintenance costs, and other components impacting the overall revenue requirement.

New England Forward Capacity Market (FCM)

After the energy and RNL markets, capacity is the next largest component of wholesale power costs in New England, accounting for approximately 14.9% in 2023. This market establishes the price ISO-NE must pay to generators for having a sufficient amount of installed capacity (also thought of as brick-and-mortar resources) necessary to assure system reliability under peak conditions. FCM can be thought of as a market to assure there are sufficient resources ready and able to operate to meet the maximum energy needs of the grid. FCM establishes the price ISO-NE charges to load to obtain revenues necessary to compensate generators for their installed capacity.

FCM clearing prices are established annually and three years in advance of the delivery period, based on auctions in

Figure 1-9. Monthly Average Natural Gas and Wholesale Electricity Prices at the New England Hub



Source: ISO-NE

which various generators and demand response resources bid their costs to supply capacity. The forward capacity auction clearing price is based on the highest bid price cleared in a reverse auction to procure enough capacity to meet ISO-NE projected peak demands in three years, plus reserves, for each planning year, beginning in June and ending in May of the following calendar year.

New England Ancillary Services Markets and Other Charges

Ancillary Services and Net Commitment Period Compensation (NCPC) are the smallest component of wholesale power costs in New England, accounting for approximately 1.1% in 2023. Ancillary services include:

- Spinning reserve capacity that can ramp up or down within specified time intervals in response to changes in load or other disruptions to the power grid;
- Regulation service provided by generators that balance supply with local demands over very short time intervals; and
- Black Start capability of generators that can be used to reenergize the power grid after a transmission line outage.

The cost of these products is paid by load-serving entities and is based on clearing prices for these services set in the ISO-NE ancillary services markets.

Maintaining an understanding of regional issues and changes in energy markets will allow WEC to understand the impacts it could see in the future from ancillary market charges.

1.8 Regulatory and Political Environment

WEC is a state-regulated monopoly with a defined franchise service territory. The Co-op's rates, quality of service, and overall financial management are overseen by the Public Utility Commission, a three-member quasi-judicial body.

The Cooperative is also under the jurisdiction of the Federal Energy Regulatory Commission (FERC), and the Rural Utilities Service (RUS), formerly known as the Rural Electrification Administration (REA).

The Co-op is also self-regulated. Unlike an investor-owned utility, WEC's cooperative governance makes it directly accountable to its member-owners. For this reason, several states chose to not regulate electric cooperatives.

The Department of Public Service appears as a party in PUC regulatory proceedings. The PUC often asks the Department for specific analyses. The Department sometimes provides informal and non-binding guidance to utilities and the public.

1.9 RES

The Co-op is also subject to Act 56, a 2015 law that established a Renewable Energy Standard (RES) for utilities to meet over time to reduce greenhouse gas emissions from the state's electric sector. The law sets requirements of 75% renewable energy by 2032, with 20% coming from in-state sources. The RES requires utilities to have renewable energy totaling 55% of retail electric sales in 2017, with that requirement growing 4% every three years to 75% in 2032 (Tier I). Of these renewable resources, some (1% of retail sales in 2017, growing to 10% in 2032) are required to be new, small, distributed generators connected to Vermont's distribution grid (Tier II). The Act also requires utilities to assist their customers in reducing fossil fuel consumption from non-electric related use (Tier III).

In addition, legislative changes to the Renewable Energy Standard would potentially force the Co-op, which for years has provided 100% renewable power, to procure more costly renewables. This would raise rates for members while enriching developers, even with carve-outs for 100% renewable utilities included in the pending bill.

1.10 IRP Objective

Every three years, WEC is required to prepare and implement a least cost integrated plan (also called an Integrated Resource Plan, or IRP) for provision of energy services to its members. WEC's Integrated Resource Plan is intended to meet the public's need for energy services, after safety concerns are addressed, at the lowest present value life cycle cost, including environmental and economic costs, through a strategy combining investments and expenditures on energy supply, transmission and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs.

The Department of Public Service has issued guidelines for utilities to follow as they develop IRPs. The state's guidance spells out baseline elements that an IRP should include. Utilities are also required to develop IRPs in accordance with the state Comprehensive Energy Plan.

After WEC submitted its 2020 IRP to the PUC, the Department and WEC also agreed on the following conditions to be included in this subsequent IRP:

1. *Refine WEC's load forecast to explicitly note and include an estimate of the impacts that all Tier III measures in aggregate have on the load forecast. WEC agrees to include not only major Tier III measures in the load forecast estimates but also other minor measures to fully flesh out and incorporate its anticipated Tier III impacts to load.*
2. *Analysis that stresses the price of Tier I/ Class II RECs in addition to the analysis included in 2020 IRP that stresses Tier II/Class I prices.*
3. *Subject to "data being readily available" to WEC, the Co-op agreed to conduct an analysis of distribution level impacts of electrification of transportation and heating, accounting for historic deployment patterns, physical limits, penetration, areas of concentration, areas of opportunity and observed spatial patterns, as appropriate and available. WEC will assess strategies to manage these new loads to minimize integration challenges and costs in the next IRP.*

Note: Our compliance with these conditions can be found in these sections of the IRP:

- Condition 1 is covered in Section 3.3, where we detail the impact of electric vehicles (EVs) and cold climate heat pumps (CCHPs) on our load forecast. Specifically, Table 3-8 shows the measures from WEC's Tier III RES compliance, and we project the impacts going forward. As we note in Section 3.3, the technology forecast assumptions used in this IRP match those in VELCO's Long Range Plan and those used by other distribution utilities. No new significant Tier III measures have been implemented since 2020; WEC believes that modeling additional technologies would not be a prudent use of our members' resources.
- Condition 2 addressed in Section 4.7. We estimate the price change for Tier 1 RECs over time and the compliance costs going forward.
- Condition 3 is addressed in part in the load forecast and work plan developed by our engineering consultant ControlPoint. WEC does not have data available on a granular level sufficient to assess the impact on particular circuits from the growth of beneficial electrification. However, ControlPoint did use some limited historical data to estimate some distribution-level impacts. For more details, see Section 8 (Transmission and Distribution) and Section 9 (Action Plan.) Our Construction Work Plan in the Appendix also has some limited historical data on load growth at particular circuits and projects future impacts of beneficial electrification.

This IRP also outlines how the Co-op is complying with various new laws passed by the Legislature in recent years, including the Global Warming Solutions Act and the Environmental Justice Act. The PUC has also urged utilities to consider the goals of the EJA (Act 154) as they develop their IRPs. The Co-op believes ensuring equity among its members – both in terms of reducing energy burdens and in easing access to beneficial electrification – is a core component of environmental justice. The Co-op's approach to Act 154 can be found in Section 7.2 and 7.3.

1.11 Risk Elements

In this IRP, WEC provides updates to the major risk elements identified in prior least cost planning documents filed in 2017 and 2020. WEC sees the biggest challenges ahead from load growth due to increased beneficial electrification and the increased cost shift and infrastructure improvements required by distributed energy resources (DER).

WEC's Transmission and Distribution (T&D) system faces unprecedented stress due to expansion of net metering/distributed generation. The current level of DER is approaching, and in some cases exceeding, the load carrying capability of some assets. WEC needs to replace aging and thermally stressed infrastructure, including rebuilding two key substations and likely re-transforming two more. WEC's T&D system must be made stronger and more resilient in order to maintain safe and reliable service, while accommodating load growth and increases in distributed generation.

> ***"The CEP recognizes that the current energy system is marked by systemic inequities that have a disproportionate impact on many of Vermont's communities, and that the transition required to meet our targets presents us with opportunities to root out and redress those existing inequalities."***
> *– Vermont 2022 Comprehensive Energy Plan*

In its 2020 IRP, the Co-op warned that the long-term impacts of the current net metering program relating to finances, equity, and grid reliability are "at worst not sustainable and at best, increasingly expensive and unequal."

Our 2024 assessment has only gotten more dire, as will be detailed in later sections of this plan.

1.12 Comprehensive Energy Plan

The 2022 CEP sets Vermont's goal to meet 25% of energy needs statewide from renewable sources by 2025, 45% by 2035, and 90% by 2050. The CEP continues the Department's prior guidance that utilities use the IRP process to analyze and develop methods to meet the CEP goals. The 2022 CEP stresses collaboration to move toward "a secure and affordable grid that can efficiently integrate, use, and optimize high penetrations of distributed energy resources to enhance resilience and reduce greenhouse gas emissions."

The 2022 Comprehensive Energy Plan (CEP) also prioritizes equity for all ratepayers as the state strives to meet clean energy goals.

1.13 Report Organization

This IRP is organized by the following topical components:

1. Situational Analysis and Challenges
2. Load Forecast
3. Power Supply
4. Modernization and Innovation
5. Resource Decision Analysis
6. Regulatory and Legislative Mandates
7. Transmission and Distribution
8. Action Plan

2. Situational Analysis and Challenges

2.1 Equity: A Core Cooperative Principle

Washington Electric Co-op and its sister cooperatives have long embraced equity for its members as a fundamental principle. As WEC and its members meet the challenges of a once-in-a-century energy transition, the Co-op remains committed to this core value. We cannot leave the most vulnerable behind and we know that when we work together, we are stronger.

The Co-op approach to ensure equity among its member-owners starts with our foundational mission. We don't set our financial goals to enrich investors; every spending and investment decision is made to protect and enhance the members' financial stake in their company.

As the energy burden data cited above shows, addressing inequities among the Co-op's members is primarily a challenge of focusing on income inequality. The Co-op works with Capstone Community Action, the regional, non-profit community action agency, to identify and target lower income members with weatherization programs so they save money on heating and powering their homes. (For more details see Section 7.)

WEC also provides incentives for income-eligible members to purchase electric vehicles and plug-in hybrid electric vehicles, a program supported by the Vermont Low Income Trust for Electricity (VLITE), a public benefit corporation formed as a result of the merger of the state's two main investor-owned utilities. Another VLITE grant funds ReWire—a program that will pay for upgrades so members can take advantage of beneficial electrification technologies. The Co-op and its partners will compile data to track these and other measures aimed at easing inequities in energy burdens.

The Co-op is also developing a tariff allowing it to join the Weatherization Repayment Assistance Program (WRAP.) This program allows on-bill financing of weatherization projects for members for whom the upfront cost of such an effort is a barrier, but who do not qualify for income-based weatherization assistance.

Over the past decade, many Co-op members have reaped the benefits of generating their own electricity, primarily through net metering photovoltaic (PV) systems. But, as detailed below, these benefits ae not shared equitably among members; lower income people are often unable to afford the upfront costs of these systems, and they also bear the cost shift that net metering causes.

To address this inequity, WEC will continue to advocate for reforms to net metering rates. In addition, the Co-op is working with the Vermont Electric Cooperative on the Affordable Community Renewable Energy (ACRE) program that will broaden the benefits of renewable generation. The ACRE program uses federal American Rescue Plan (ARPA) funds to develop community solar projects that will also provide rate relief to some of WEC's low-income members. We expect that the program will provide a roughly $45 a month discount to as many as 240 income qualifying WEC households for five years.

2.2 Power Supply Strategies

Many factors influence WEC's power supply management strategies, including the timing and volume of energy consumed by the membership, statewide renewable energy mandates, and the relative cost of various power supply products and services available in the region. WEC's power supply analysis begins with an assessment of its needs. For 2023, WEC's energy settlement load obligation with ISO-NE plus internal generation was 79,212 MWh. This value represents the Cooperative's retail sales, distribution and transmission losses, unbilled accounts, and internal generation, and includes the impact of reduced sales due to net metering. To hedge its load obligation, the Cooperative's power sources in 2023 totaled 79,682 MWH.

Beneficial electrification is now forecast to increase load on WEC's system, even with net metering and energy efficiency included in the forecast. Unlike forecasts in past IRPs, net metering will not mask load growth into the future, as detailed by both the Itron load forecast and ControlPoint's assessment of WEC's current and future T&D infrastructure needs. [See Sections 2, 3 and 8.]

While load growth caused by beneficial electrification is a benefit for both members switching away from fossil fuels and for WEC's finances, WEC's peak demand is a significant cost that is also expected to increase. WEC's peak demand occurs in the winter and in the evening, at which time solar net metering is not producing energy. That means that although WEC will be obligated to continue accepting net metering, there are no peak cost benefits from solar—and the Co-op is required to pay a premium for the less valuable power during the day, which is an additional cost for non-net metering WEC members.

WEC's power supply is made up of owned generation

Table 2-1. 2023 Electricity Supply Resources

Resource	2023 MWH	%	Fuel	Exp. Date
Coventry Landfill	51,756	65%	Landfill Gas	Life of Unit
HQUS Contract	6,848	9%	Hydro	10/31/2030
NYPA Niagara Contract	10,131	13%	Hydro	4/30/2032
NYPA St. Lawrence Contract	336	0%	Hydro	4/30/2032
Ryegate Facility	2,271	3%	Wood	10/31/2032
Sheffield Wind	6,044	8%	Wind	10/18/2031
Wrightsville Hydro	2,296	3%	Hydro	Life of Unit
TOTAL RESOURCES	**79,682**	**100%**		

and long-term contracts. The resources in WEC's portfolio are 100% renewable, and about two-thirds come from the Coventry Landfill. Every year WEC's power supply portfolio provides excess energy which hedges against the cost of serving load in ISO-NE's energy, capacity, and ancillary markets. These power supply resources are summarized in Table 2-1.

2.3 Systemic Upheaval from Distributed Generation

Distributed generation – primarily from solar projects – has transformed Vermont's electricity sector. Under the state's net metering program, first authorized in 1998, electric consumers were incentivized to offset their own electricity consumption. But what started as a program to boost small-scale projects (15 kW) has expanded to one that allows projects up to 500 kW. There is no longer a requirement that a net metered solar array physically offset a customer's load, effectively making net metering in some cases akin to merchant generation.

This distributed generation piece of the energy transition has actually increased costs for members. WEC, following its fundamental cooperative principles, must ensure this move to cleaner, more efficient electricity use does not leave some members behind or saddle them with additional costs for electric vehicles, heat pumps, or net metering that they may not be able to benefit from.

In 2022 more than 75% of the electricity produced by net metered generators statewide was exported directly to the grid, according to the Department of Public Service's 2023 net metering report.

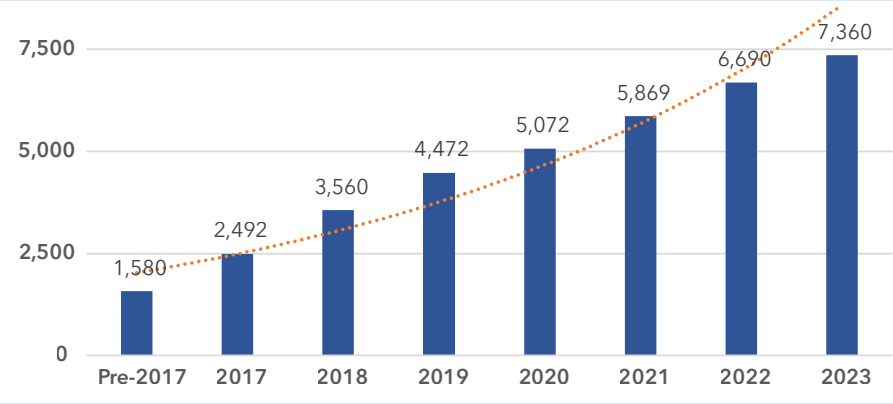
Net metering generation capacity has now grown to be equivalent to over 32% of Vermont's peak demand, and even more in WEC's territory. Although the program has been restructured with lower incentives, the reimbursement rate utilities must pay for the net metered power often still exceeds that of other renewable resources. This price differential has resulted in a cost-shift from members who have net metered projects to those who don't.

In its 2023 report, the Department of Public Service warned that this cost-shift causes inequities among customers:

> *"[S]ince net-metering customers have reduced their electric bills, they do not experience the brunt of this cost-shift to the same degree as customers who do not have net-metering systems or credits. Customers have the right to manage their electric usage, including through on-site generation, to reduce purchases from their electric utility," the Department's report said. "However, there is no corresponding right to have other electric customers subsidize this practice; and with increasing adoption of heat pumps and electric vehicles, net-metering is starting to result in Vermonters paying for the heating and transportation costs of net-metered customers in addition to the electric costs."*

All Vermont utilities host net metering projects, although the distribution varies widely from utility to utility. WEC has among the highest number of net metered projects

Figure 2-1. Net Metering Growth



Source: WEC, JJ Vandette

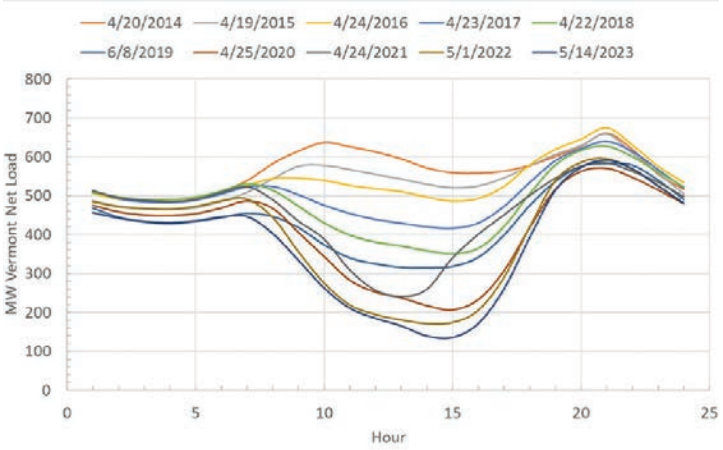
as measured as a percentage of the utility's total member-owners. As of December 2023, WEC had 893 net metering projects installed on its grid, totaling 7,360 kW of generation capacity.

2.4 Solar – No Impact on Peak

VELCO, Vermont's grid operator, has documented the impact to the grid from the rapid development of in-state renewables. Small-scale solar now accounts for 500 MW of production, with utility-scale solar another 20 MW. This has reduced the state's electricity demand during the day (under sunny conditions) and has shifted both the winter and summer peak to nighttime hours. As noted in the following VELCO chart, summer peaks in particular have seen a drastic shift from midday hours hour-ending 18 (6 PM) and later. For this reason, new solar photovoltaic (PV) generators on WEC's system have no offsetting impact on Vermont's or the Co-op's summer peak demand.

"Customers have the right to manage their electric usage, including through on-site generation, to reduce purchases from their electric utility. However, there is no corresponding right to have other electric customers subsidize this practice; and with increasing adoption of heat pumps and electric vehicles, net-metering is starting to result in Vermonters paying for the heating and transportation costs of net-metered customers in addition to the electric costs."
– DPS 2023 net metering report

Figure 2-3.
Solar PV Impacts On Vermont Springtime Net Loads



Source: VELCO. This shows the classic duck curve or "Champ" curve of Vermont's load as influenced by solar on the grid.

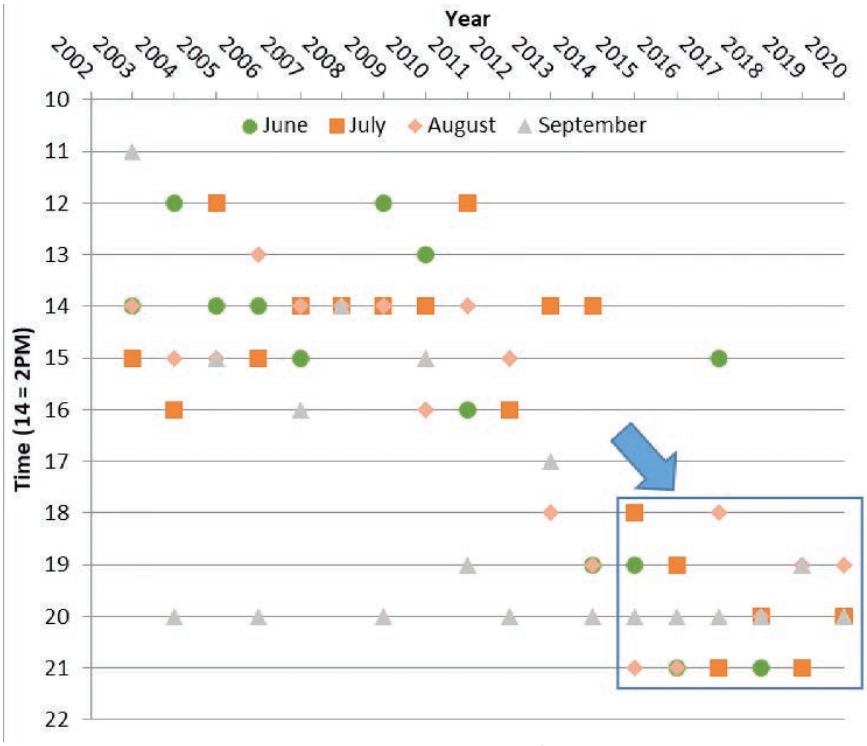
During days when the load on the grid is low and solar output is high, the existing solar on the Vermont grid creates a "duck curve" as indicated in the following chart. The "belly" of the duck has been seen to go below the x-axis in recent years, indicating that the Vermont system is exporting more energy than it is using.

In WEC's territory, back-feeding energy from excess solar is causing issues at many substations, and WEC is planning for significant, costly upgrades to be able to accommodate this reverse power flow. The following chart shows the impact of net metering at WEC's Jackson Corners substation as an example. During the day in both the spring and fall, net metering reverses the flow of energy at rates that are often greater than the peak demand. Note that when demand goes below zero, the amount of total net metering solar produced behind the substation at that time is far greater than the amount of energy being used.

The total amount of net metering installed across WEC's entire territory is so great that the WEC system was producing more power than it was using for more than 60 distinct hours in 2023. Unfortunately, this energy "exporting" takes place when energy prices across the region are depressed (and sometimes negative) because of the excess solar generation throughout ISO-New England.

Historically, net metering solar has had many benefits. Across Vermont, net metering solar has been very successful at reducing daytime peak demand in past years, but, consequently, solar has "pushed" the costly peak hours to outside of daytime hours. [See Figure 2-3] While solar systems do produce

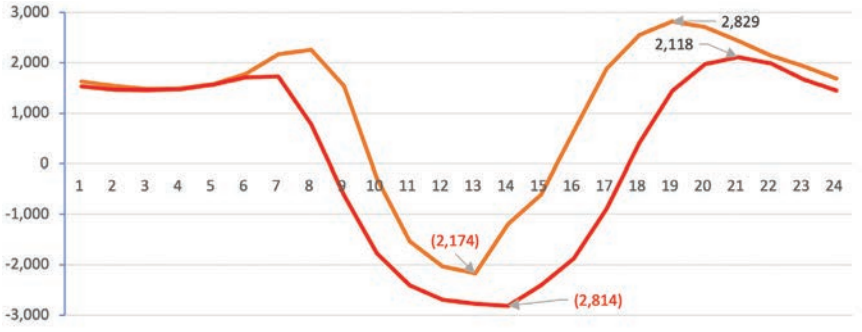
Figure 2-2.
Vermont Summer Peak Demand Now Ocurrs In The Evening



Source: VELCO 2021 Long-Range Transmission Plan

Figure 2-4.
Net Metering Impact on WEC's Jackson Corners Substation

Jackson Corners Net Load (kW)
on May 18, 2023 (Orange) & Nov. 2, 2023 (Red)



Source: WEC

carbon-free energy, WEC is already 100% carbon free.

WEC now forecasts a steady increase in winter peak demand – from a 16.87 MW system peak in 2024 to a 25.8 MW peak in 2034. See Figure 2-8.

The WEC system has historically been a winter peaking system. On WEC's system, and at the Vermont state level, winter peaking loads have occurred—and are forecasted to continue to occur—outside daylight hours. Therefore, the winter peak demand benefits are zero for PV net metering generators.

WEC calculates that net metering costs its members $1.09 million annually after benefits from that power are factored in. WEC's sparsely populated territory and the modest income of its members make WEC particularly sensitive to rate pressures. If taken on their own, those net metering expenses would represent a roughly 5.6% increase in rates.

2.5 WEC Position: Pay on Avoided Costs

Following key cooperative principles of equity, WEC has urged the Legislature to change the net metering program to lower reimbursement rates and to reduce subsidies.

The PUC has acknowledged that its recent changes to net metering represent "only a modest decrease in compensation." To avoid putting undue costs on members who are struggling financially, and to avoid disincentivizing the adoption of electric vehicles and heat pumps, WEC believes the Legislature should direct the PUC to set the compensation for excess generation from net metering at the distribution utility's avoided costs.

This would mean that the non-net metering ratepayers of a utility would pay for excess net metering generation at the value that power actually provides at the time, rather than an inflated and subsidized rate. With this change, those who wish to develop net metering systems could do so without causing financial harm to their neighbors.

Subsidizing net metering was an important public investment to help kickstart the residential scale renewable energy sector in Vermont. However, as the industry has become well established, the public benefits of these subsidies are no longer in balance with the costs. The economic structure of net metering as it currently stands allows ratepayers who have the means and upfront capital to install net metered systems to incur private economic benefit at the expense of publicly shared assets like the grid and our cooperatively owned utility. Members who are not able to install net metered systems are now directly paying for their net metering neighbors, as well as providing profit to renewable energy developers.

WEC's priorities include strengthening the shared grid infrastructure and increasing storage capacity to improve our ability to efficiently utilize renewable generation, expanding investments in weatherization, and supporting transitions to beneficial electrification technologies. In its current format, Vermont's net metering program makes achieving all three of these priorities more difficult.

The PUC said it strives to balance the benefits of the program with its costs, "particularly on those Vermonters who are energy burdened."

High electric rates can delay the switch to beneficial electrification. The PUC, in its latest biennial update on net metering incentives, warned that the cost of net metering could actually be counterproductive to the goal of encouraging the use of electricity for transportation and heating, due to the rate increases it causes.

"Vermont's energy policy should continue to support a healthy net-metering program, but that support should not be paramount to or otherwise detrimental to the efficacy of other programs that promote similar policy outcomes at a lower cost." – Vermont PUC, June 17, 2022.

The PUC noted that "over-reliance on net-metered systems for renewable generation could have the unintended, counterproductive effect of reducing investment in more cost-effective means of reducing Vermont's greenhouse gas emissions, such as electric vehicles and cold-climate heat pumps."

Some of WEC's member-owners have among the highest energy burdens in Vermont [See Section 1.5 on energy burden]. Net metering has added to that burden.

2.6 Beneficial Electrification and the Equity Challenge

Washington Electric Co-op is a leader in reducing energy consumption and developing renewable energy sources, and Vermont as a whole also punches above its weight in meeting national clean energy targets. According to the U.S. Energy Information Administration state-by-state Vermont

had the lowest total CO2 emissions of all 50 states. Vermont also has the cleanest electric supply in the country, according to the Vermont Department of Environmental Conservation's Greenhouse Gas inventory. Electricity accounted for just 2% of greenhouse gas emissions, according to the Energy Action Network's 2023 Annual Progress Report. Transportation and heating remain the largest sources – 72% – of carbon emissions.

Vermont's clean electricity portfolio offers great promise as the state strives to meet required greenhouse gas reduction goals through a focus on beneficial electrification. The Energy Action Network defines beneficial electrification as "investing in high-efficiency electric heating/cooling systems and electric vehicles to replace ones that rely on more expensive and polluting fossil fuels."

> ***"A well-designed state policy of beneficial electrification can reduce greenhouse gas (GHG) emissions, reduce consumer costs, and help mitigate health impacts of burning fossil fuels. The two primary examples, most important to Vermont, are replacing fossil fuel heating appliances with cold-climate heat pumps and replacing internal combustion engine (ICE) vehicles with all electric vehicles (AEVs)."***
> ***– EAN VT***

President Biden has set a goal that 50% percent of all new vehicle sales will be electric by 2030. The federal government has advanced public and private commitments to support America's historic transition to electric vehicles (EV) under the EV Acceleration Challenge.

The shift to electric transportation is also one of the main features of the state's 2021 Climate Action Plan, which provides a path for the state to meet its ambitious greenhouse gas emissions goals as outlined in Vermont's 2020 Global Warming Solutions Act.

As of October 2023, 11,000 plug-in EVs were registered in the state. Meeting state emissions goals for the transportation sector would require about 27,000 plug-in EVs registered in Vermont by 2025 (including plug-in hybrids) and 126,000 by 2030, according to legislative testimony from David Roberts, VEIC consultant to the House Transportation Committee in January 2024.

Both the federal government and Vermont have established substantial financial incentives to buy electric vehicles through tax credits and subsidies.

WEC expects that more of its members who can afford the up-front costs of PEVs will buy them due to potential operating cost savings and the incentives offered by both the state and federal government.

WEC offers incentives ranging from $250 to $1,200 for an all-electric vehicle, depending on income eligibility. WEC also offers its members at no cost Level 2 charging equipment and a $500 rebate upon connection once the member's service entrance and transformer have been suitably sized, according to the Co-op's calculation of transformer capacity. These incentives were slowed during and immediately after the COVID-19 Pandemic as supply chain issues made the necessary transformer upgrades difficult to accommodate while leaving equipment for necessary system upgrades and repairs. This has recently become less of an issue.

These incentives are having an impact. According to data from Drive Electric Vermont, WEC members' EV registrations in 2023 totaled about 414 vehicles.

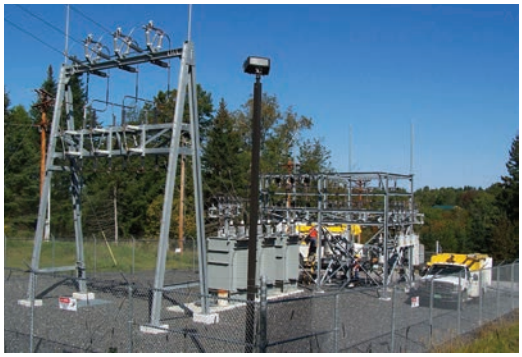
2.7 Cost and Infrastructure

Due to increasing electrification and the addition of new members, WEC is now experiencing significant load growth and a high rate of Distributed Energy Resource (DER) deployment. This is a significant factor, although not the only factor, in WEC's need to replace aging and thermally limited assets such as the #8 Jackson Corners and #3 Mount Knox substations.

The current level of DER penetration is approaching, and in some cases exceeding, the load carrying capability of some assets. A prime example is the #8 Jackson Corners substation transformer, which is at risk of overload due to reverse power flow from DER during times of high solar output and also during peak demand times due to normal system loads. More details can be found in Section 8, Transmission and Distribution.

Reliability remains a chief concern for both WEC and its members. In order to continue to provide safe and reliable service while accommodating the increases in load and distributed generation, WEC's Transmission and Distribution (T&D) system must be made stronger and more resilient with greater redundancy and connectivity. These needs are further highlighted by the increasing frequency of extreme weather events.

Parsing out the costs of infrastructure between aging facilities that need to be upgraded and the impacts of distributed generation can be difficult to do with accuracy. For example, Jackson Corners needs more capacity in its devices, but it also needs a total rebuild of the structure of the substation. So, while limitations on distributed generation or installation of utility scale battery storage might delay the need for this rebuild it will only put it off temporarily. And in some cases, the costs for upgrades (such as Transmission Ground Fault Overvoltage) may be able to be assigned accurately to distributed generation sources, in others such as substation upgrades such allocation is difficult or impossible.



Metering infrastructure is another major upgrade on the immediate horizon. WEC must make substantial investments in its Advanced Metering Infrastructure (AMI) for a variety of reasons, as described in detail in later

sections. The benefits will include more efficient response to outage and restorations and the ability for members to take advantage of time-of-day (TOD) rates. Although WEC has Power Line Carrier AMI currently, interference from heat pumps, net metering, and others issues as well as data storage and analysis issues have hampered a well-functioning TOD rate so far.

2.8 Load Growth, Winter Peak

The boom in "behind the meter" distributed generation–most often from net metered solar projects–has historically masked growth in load in the Co-op's territory. However, now load is forecasted to grow faster than the rate of net metering adoption. Additionally, peak demand has shifted to after dark in winter, when member demand rises, and solar projects contribute nothing to the grid. This trend will increase with beneficial electrification as EVs and heat pumps become more widely adopted by Co-op members.

The ISO 2050 Transmission study predicts a similar paradigm shift for New England as a whole. The region transitions to winter peaking and electrification of heating and transportation more than doubles peak power consumption by 2050.

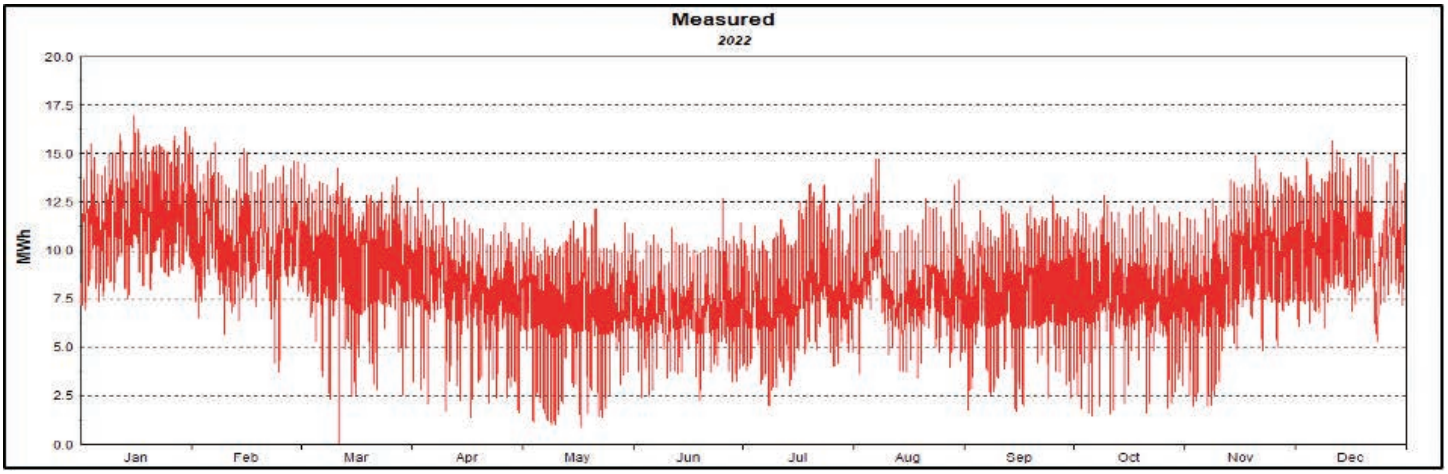
Itron, the Co-op's load forecast consultant, has modeled this trend over time. In order to accurately forecast demand, Itron added solar back to the system load.

One of the challenges in modeling WEC loads is the significant amount of solar generation embedded in sales and system load data. To illustrate, Figure 2-5 shows measured system load and Figure 2-6 shows load with solar generation added back in (Reconstituted).

As our objective is to forecast member and system energy requirements (regardless of the source), models are estimated with reconstituted sales and loads. The final forecast is derived by then subtracting out the solar generation forecast.

"Expected PV adoption negatively impacts energy growth but has a limited to no impact on peak demand as the system peak has moved out to later hours from past solar adoption. Most of the load growth is driven by EV charging and CCHP."
– ITRON 2023 Demand Forecast

Figure 2-5. Measured Load



Source: Itron. The red chart is what it looks like (metered) and the blue is what Itron modeled (reconstituted).

Figure 2-6. Reconstituted Load

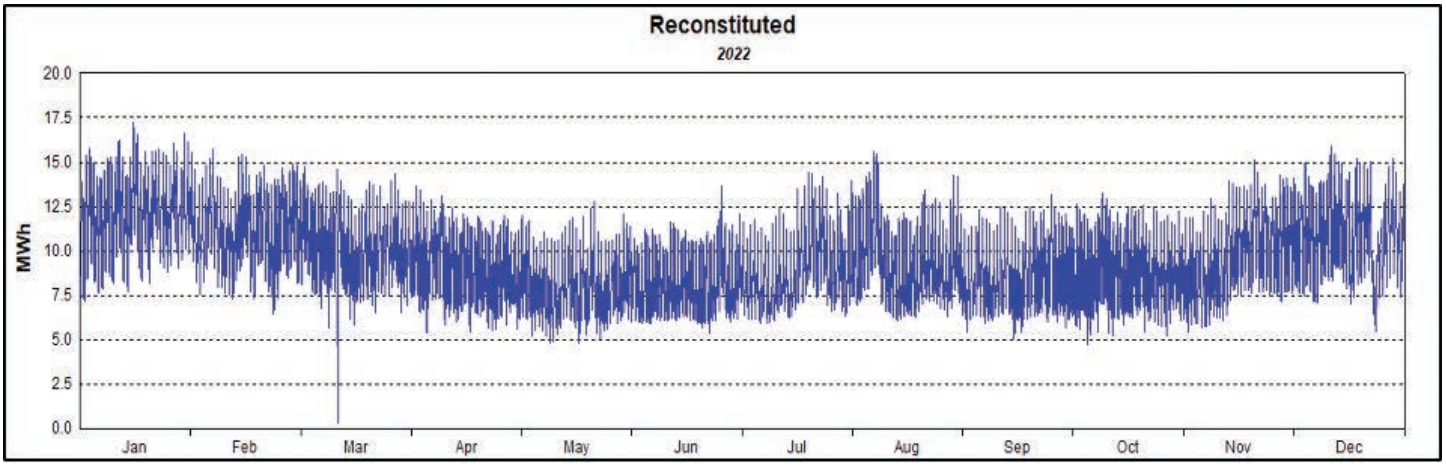
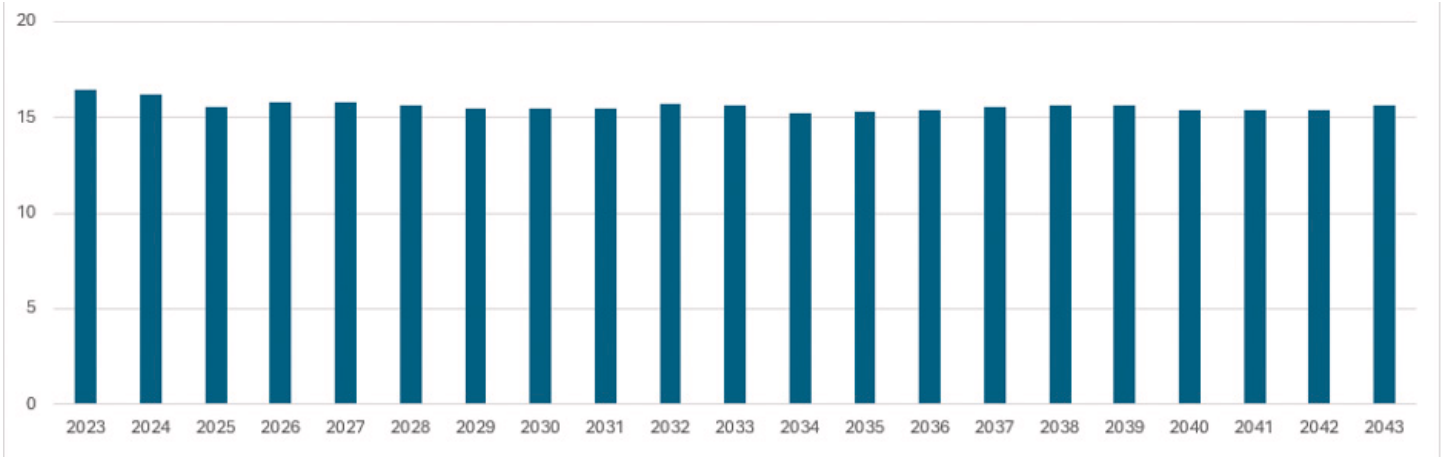


Figure 2-7. Baseline Demand



Source: Itron

The baseline demand reflects usage before EVs, heat pumps, and additional solar load. (It includes residential own-use generation through the estimation period.) This demand trend is driven by member growth, economic activity, and end-use efficiency trends.

However, when all the components are factored in, the forecast for the Co-op is for strong winter peak demand growth.

Figure 2-8. Forecast For System Peak

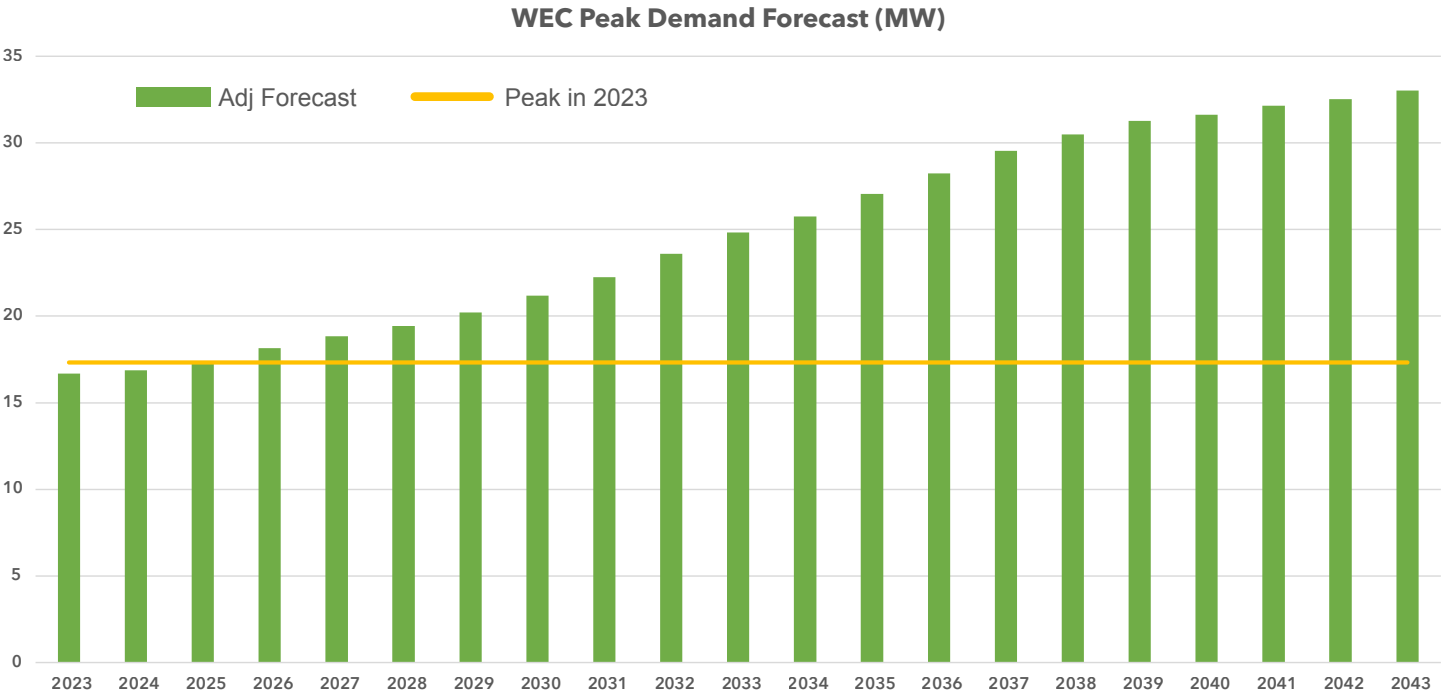
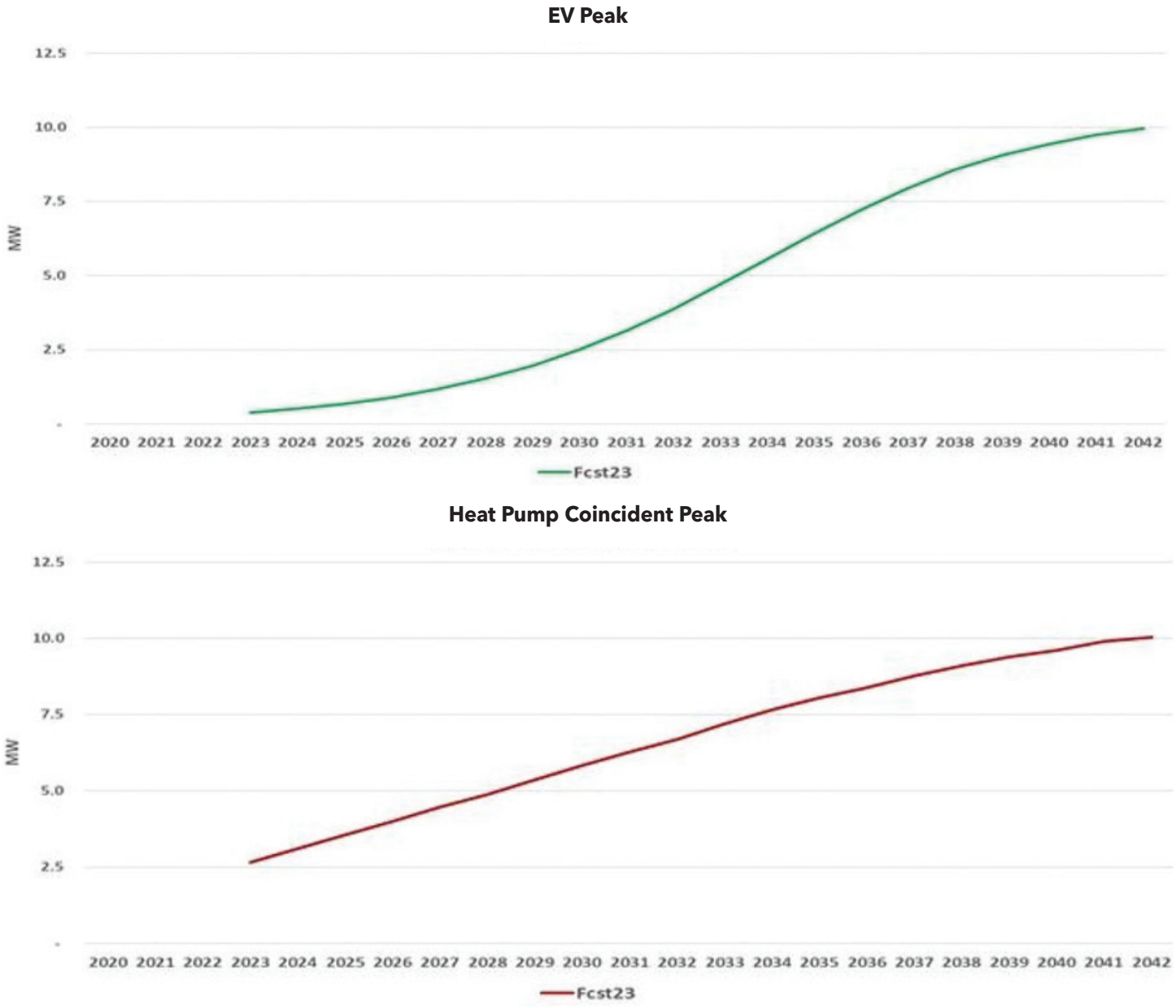


Figure 2-9. EV and Heat Pump Impact on Load



In WEC's territory, projected rates of adoption for EVs, CCHPs, and PVs will significantly drive load, as seen in Figure 2-9.

Over the next 20 years, energy requirements are expected to average 2.5% annual growth. This compares with baseline annual sales increases of 0.1%. Winter adjusted peak averages 3.5% annual demand growth and summer 2.5% average annual demand growth. Analysis by VPPSA, acting as WEC's power supply consultants, predicts an average of 2.6% annual growth and summer 2.6% average annual growth, both in line with the Itron projection.

2.9 Storm Frequency, Severity, and Impact

Vermont's weather is becoming wetter, warmer, and stormier. These impacts from global climate change have already caused more frequent and intense power outages in the Co-op's territory.

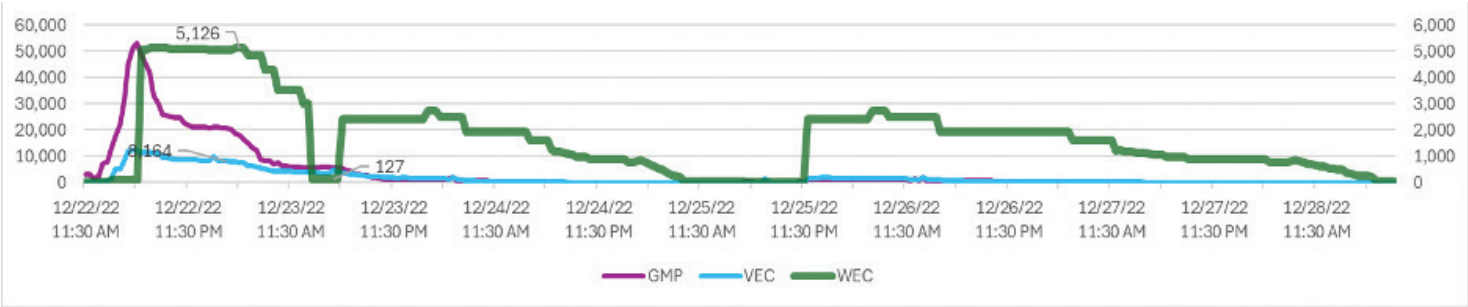
The storms that hammered central Vermont in late November and early December of 2023 are a likely preview of what's to come as the climate continues to warm. On Nov. 27, wet snow weighed down lines, causing multiple,

sustained outages that affected about half the membership. That Monday storm was followed by two more on Dec. 3-4 and Dec. 10-11.

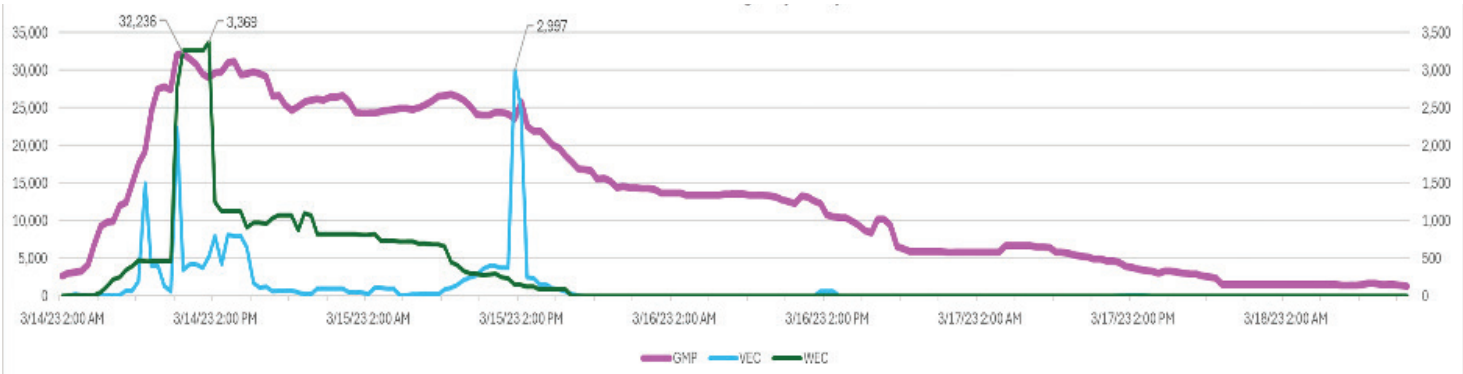
The triple whammy weather event caused multiple and sustained outages in communities in northern and central Vermont. The utilities serving the region sustained varying but comparably severe impacts over the three storms, as can be seen in Figure 2-10.

Figure 2-10. Customers Outages by Utility Nov. 27, Dec. 4, and Dec. 11, 2023

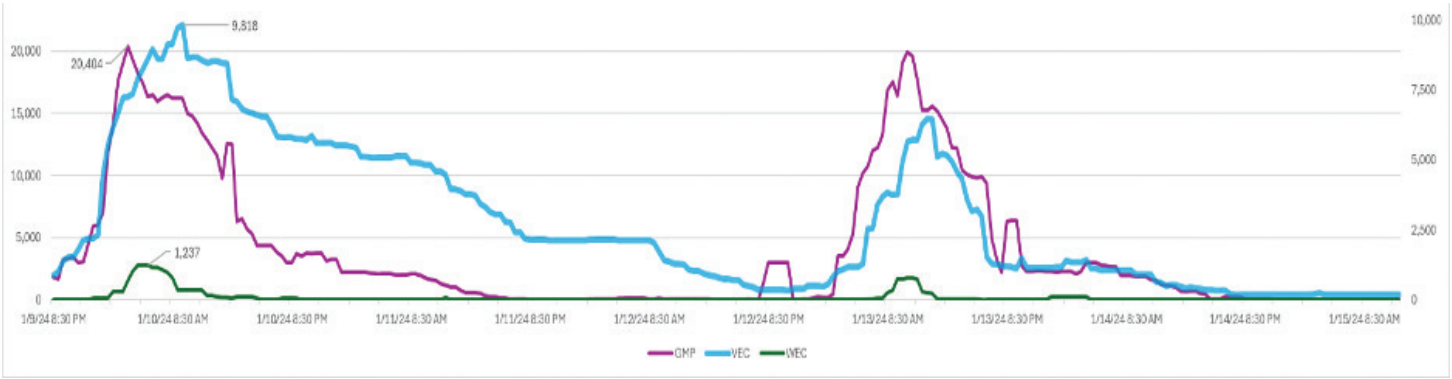
December 2022 Storm



March 2023 Storm

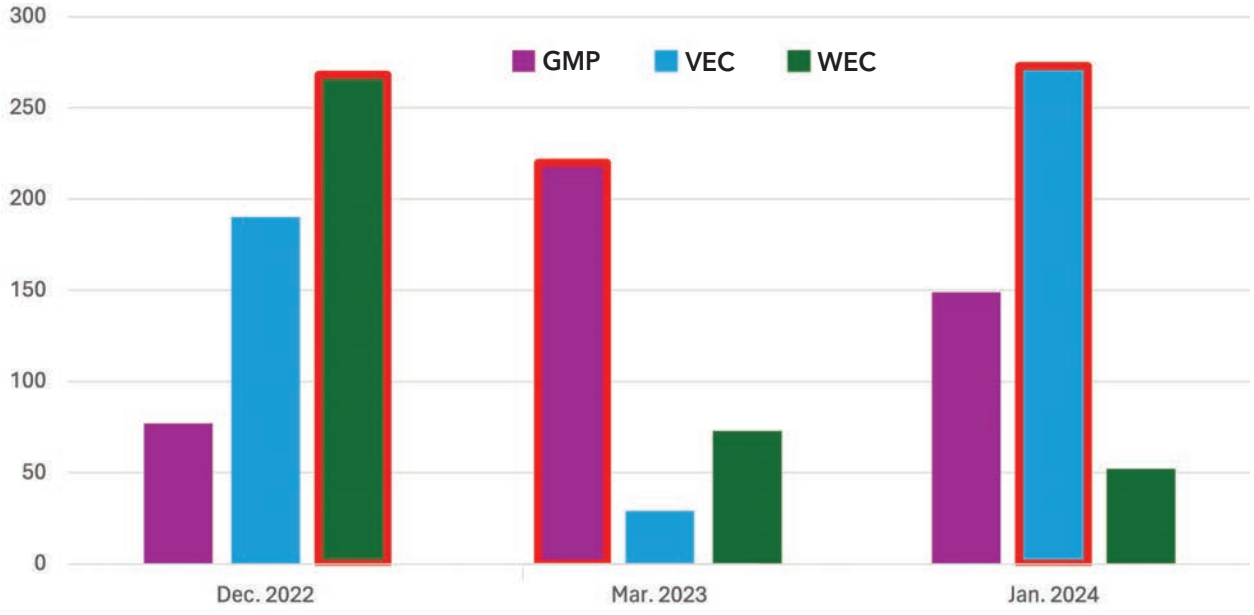


January 2024 Storm



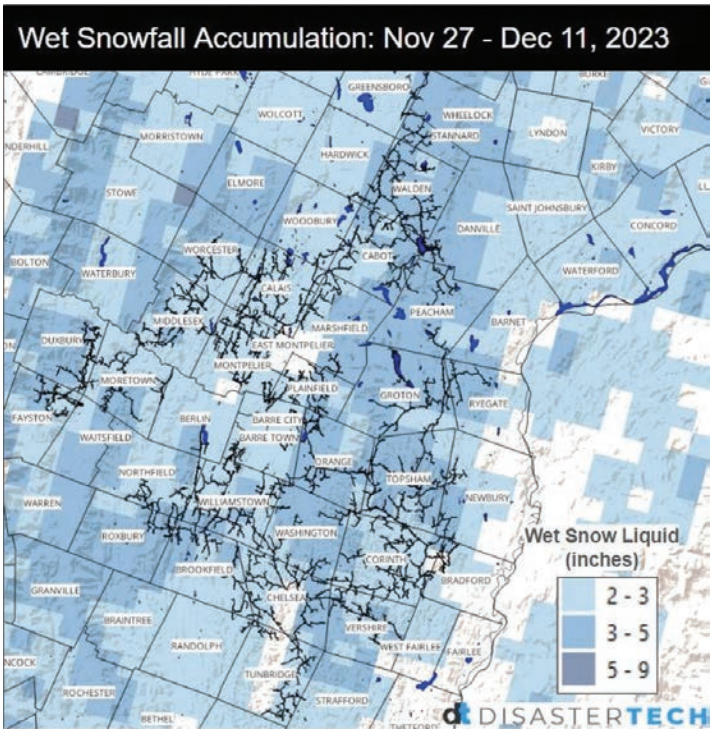
Summary Table of the Three Figure 2-10 Charts

Number of Hours When Outages Were >0.5% of Total Utility Customers



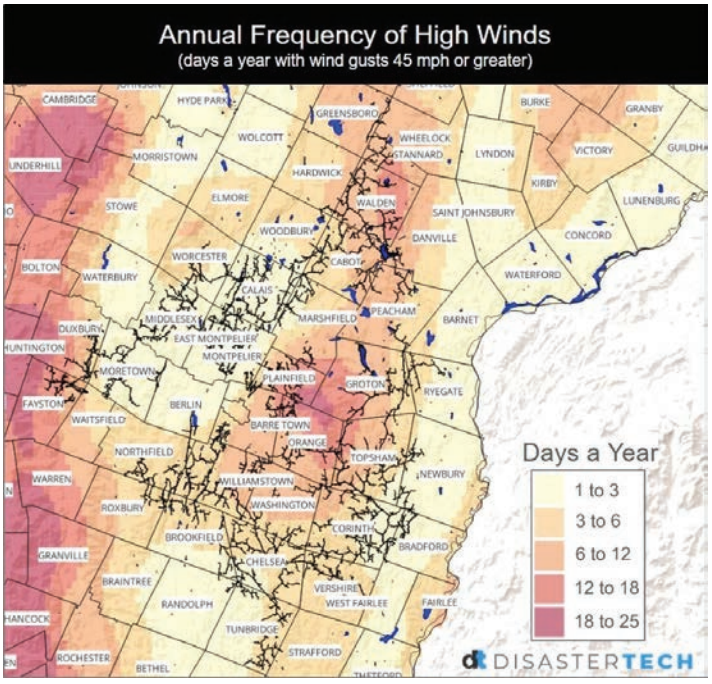
Source: https://vtoutages.org/

Figure 2-11. Wet Snow Accumulation On WEC's Lines, Aggregated For The Three Storm Events, Nov. 27, Dec. 4., Dec 11, 2023



Source: Dr. Jason Shafer, Disaster Tech Inc.

Figure 2-11. High Wind Frequency



Annual frequency of high winds as shown on the Co-op's service territory and power lines. Source: Dr. Jason Shafer, Disaster Tech. Inc.

The 2021 study found that overall weather-produced distribution system outage impacts are expected to increase by approximately 5% through 2049. The three most likely weather events to cause outages are wind, wet snow, and ice. Many storms bring all three factors to bear on the Co-op's lines.

Because the overall climate trend is for a lengthening warm season, the fall storm season will extend into early winter. Yet despite a warming climate, the study found that the winter season will remain cold enough to sustain wet snow and ice risks through 2049.

As meteorologists look to the future and forecast the

Figure 2-12. Wet Snow And Windstorm Grid Stress Over Three Recent Storms

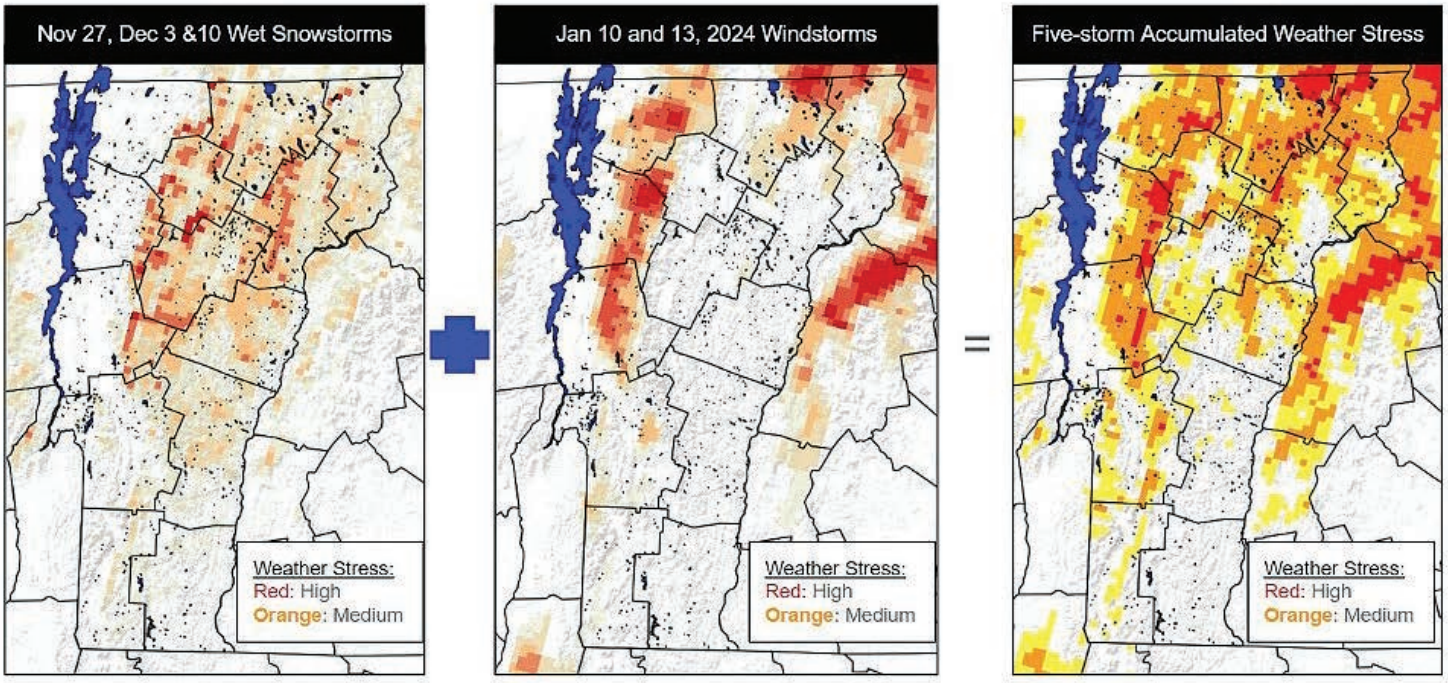
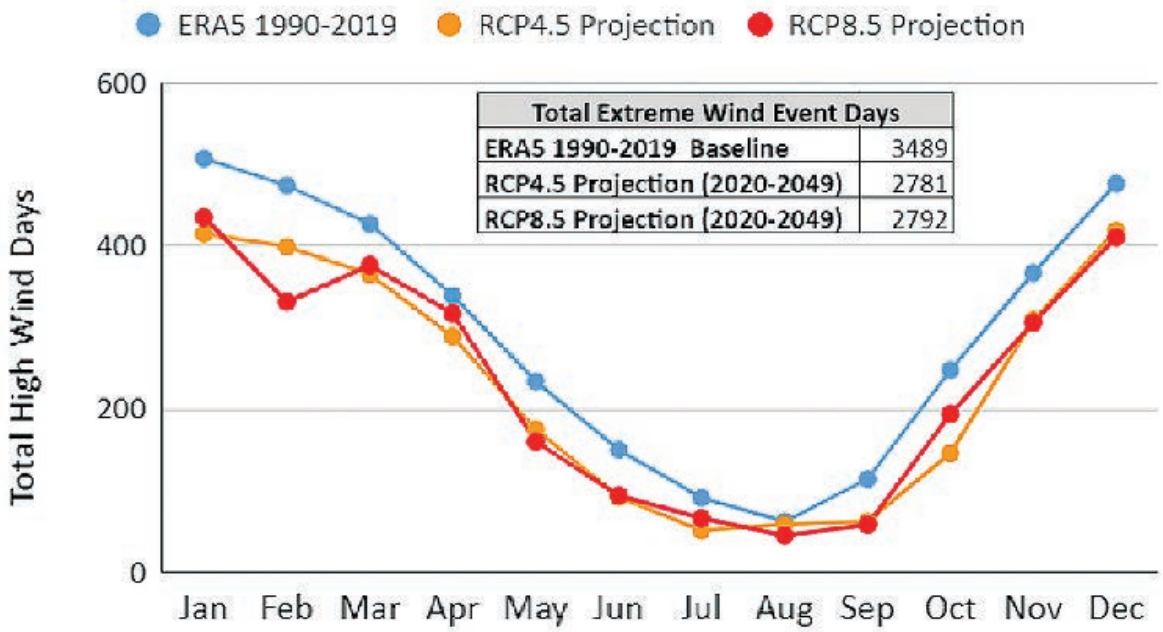
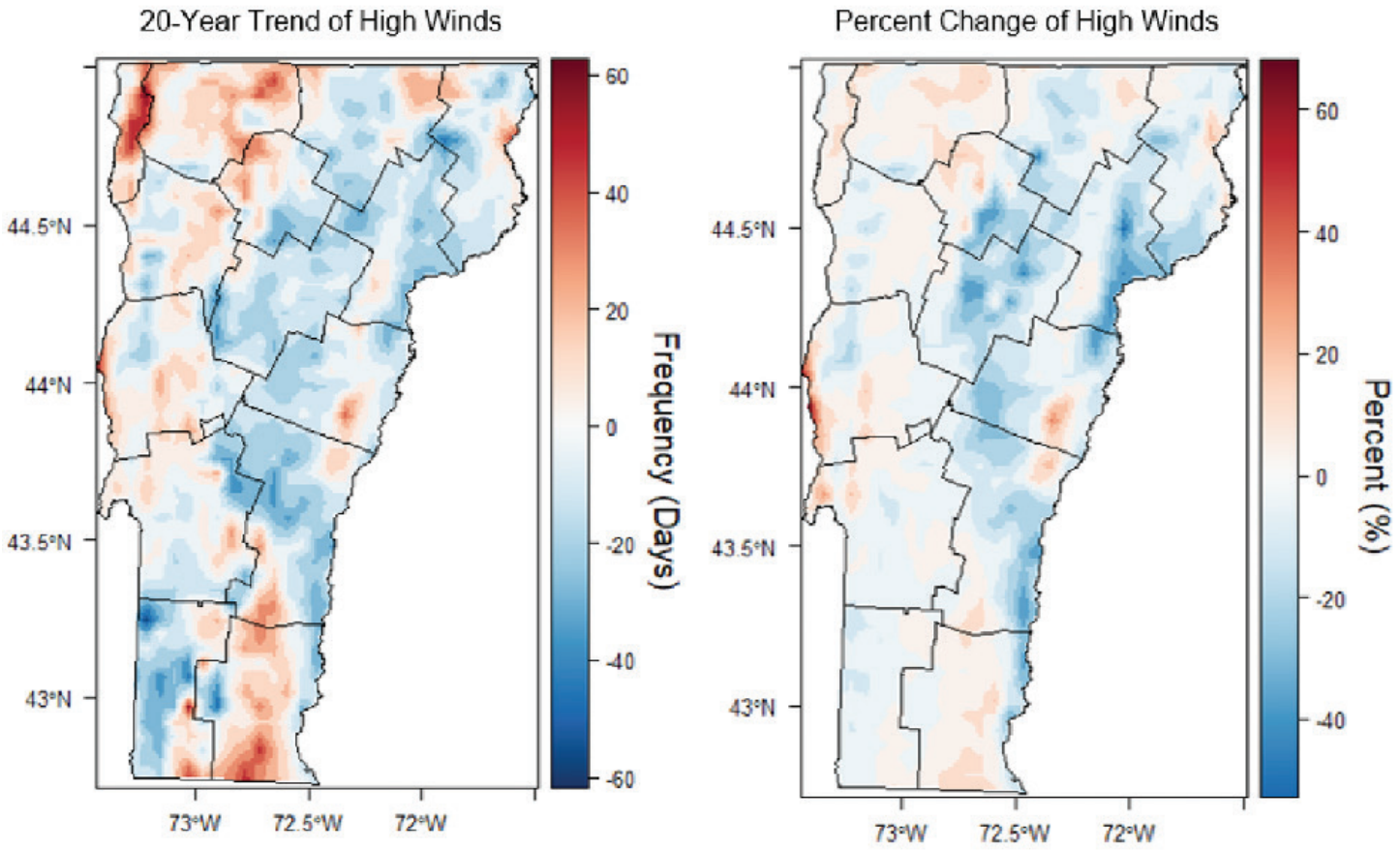


Figure 2-13. Extreme Wind Events



Gradient wind frequency for historic baseline (1990-2019) and climate simulations. Source: Northview Weather LLC report for VELCO, Nov. 1, 2021

Figure 2-14. 20-Year Trend of High Wind Events



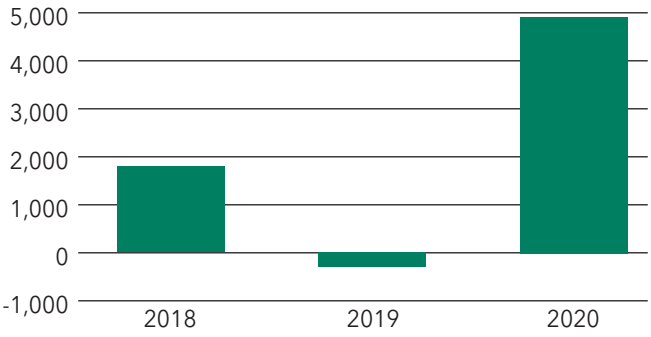
Difference in the number of extreme wind days between 1980-1999 and 2000-2019 using the downscaled ERA5 5km (left). Percent difference in the number of extreme wind days (right). Source: Northview Weather LLC report for VELCO, Nov. 1, 2021

increase in weather severity that will affect grid reliability, they place the highest confidence in predicting damage from wet snow.

Other factors affecting reliability may be harder to predict as precisely, but they are also exacerbated by a warming climate. These include freezing rain, flooding, and wind. For example, a warmer winter may have the same amount of wind as a colder one. But the same force wind can cause more damage when the ground is not frozen, leading to the risk of uprooted, toppled trees falling on power lines.

To prepare for these increased risks from climate change, WEC is improving its outage management and response and hardening its lines where appropriate and affordable, as seen in the Transmission and Distribution section of this plan.

Figure 2-15. Pandemic Population Influx



Source: Public Assets Institute citing U.S. Census

2.10 Demographics: Post-Pandemic Population Trends

The full societal impact of the coronavirus pandemic will not be known for some time. One thing is very clear: Vermont became an attractive refuge for people seeking safety and a better place to live. Census data show that Vermont's population swelled by about 5,000 people from 2020-2021. The increase follows a net loss in population in 2019 and totals more than two-and-a-half times the number of people who relocated to Vermont in 2018.

The pandemic-induced in-migration exacerbated already skyrocketing real estate prices. It also led to an increase in residential electricity use as more people worked from home, and more people moved to the region full time.

However, despite this population influx, Vermont still faces troubling demographic trends. The Legislature's Joint Fiscal Office (JFO) reports Vermont's population grew about 10% from 2010 to 2022. But the number of working-age people declined, which means the state has fewer income-

earners on whom to rely for tax revenues and to fund social or clean energy programs.

The in-migration Vermont experienced in the pandemic is not a panacea for this problem, as the JFO report noted:

"Even as more people moved to Vermont during the COVID-19 pandemic, the influx of working-age adults was not big enough to boost the number of working-age people relative to the overall population. Birth rates dropped sharply during the pandemic," The JFO said. "If the goal is to grow its overall population and share of working-age residents substantially, Vermont faces a tough road ahead."

The demographic reality of our aging population adds to the equity challenge facing the Co-op and its members. With fewer working people to support the state's tax burden, the Co-op must not exacerbate the problem by shifting energy costs to those living on fixed or low incomes.

An all-electric Chevy Bolt outside WEC's warehouse.

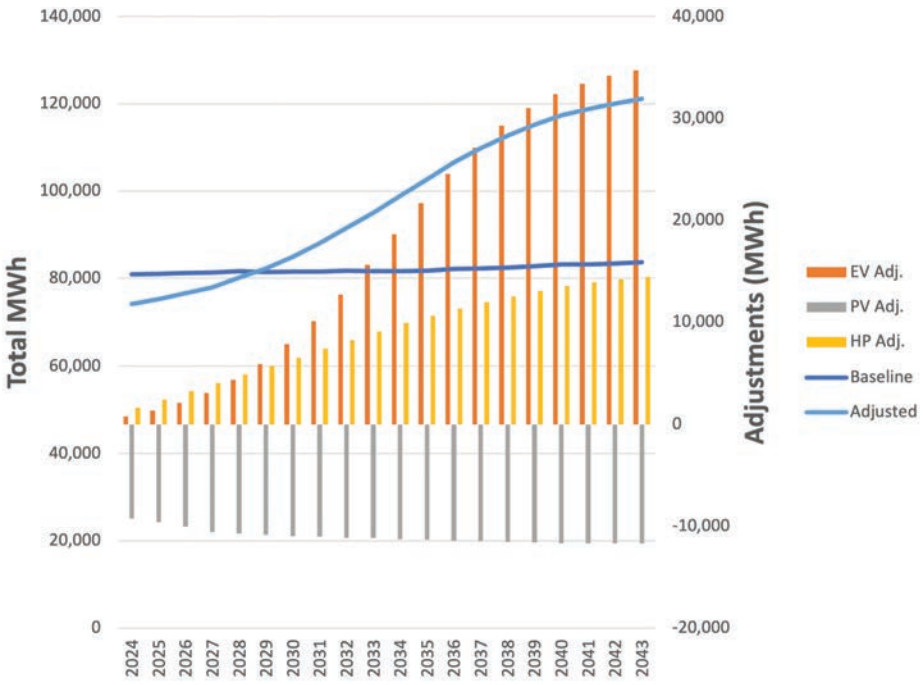
3. Load Forecast

Washington Electric Co-op worked with the Vermont Public Power Supply Authority (VPPSA) to develop load forecasts for the Co-op under various scenarios.

VPPSA retained Itron to forecast WEC's peak and energy requirements. The Itron team used the SAE (Statistically Adjusted End Use) methodology with the same electrification inputs and assumptions that were developed by the Vermont System Planning Committee (VSPC) during VELCO's 2021 Long-Range Transmission Plan (LRTP). Specifically, the adoption rates for heat pumps and electric vehicles (also known as "beneficial electrification") are shared with the LRTP.

The following sections outline WEC's 2023 long-term forecast, which includes energy and demand peaks underpinned by forecasts of member class sales and adjusted for the impact of electrification technologies through 2043. The forecast is based on a bottom-up framework where long-term demand is driven by underlying sales (residential, commercial, industrial, street lighting, and other uses). The impact of new technologies is then layered on top of the baseline forecast.[1]

Figure 3-1. Adjusted Energy Forecast (Mwh/Year)



3.1 Energy Forecast Results

Table 3-1 shows the Baseline Forecast and the adjustments made to arrive at the Adjusted Forecast. The effect of these electrification and net metering measures on the slightly increasing retail sales is a larger increasing adjusted forecast. The compound annual growth rate of the adjusted forecast is about 2.6%.

Energy Forecast–High and Low Cases

To form a high case, we assumed that the increase in penetration per year for EVs and CCHPs doubles compared

Table 3-1. Baseline and Adjusted Energy Forecast (MWh)

Year	Year #	Baseline Forecast	Cumulative EV Adj.	Cumulative NM PV Adj.	Cumulative HP Adj.	Adj. Forecast
2024	1	80,964	782	-9,236	1,615	74,124
2028	5	81,633	4,354	-10,715	4,902	80,174
2034	11	81,641	18,623	-11,270	9,903	98,896
2038	15	82,474	29,259	-11,552	12,523	112,704
2043	20	83,697	34,718	-11,704	14,396	121,107
CAGR		0.2%				2.6%

1 2023 Long-Term Forecast Model Overview, Itron, 2023

Table 3-2. Energy Forecast – High Case (MWh)

Year	Year #	Baseline Forecast	Cumulative EV Adj.	Cumulative NM PV Adj.	Cumulative HP Adj.	Adj. Forecast
2024	1	80,964	1,563	-9,236	3,230	76,521
2028	5	81,633	8,708	-10,715	9,804	89,430
2034	11	81,641	37,246	-11,270	19,806	127,422
2038	15	82,474	58,517	-11,552	25,046	154,485
2043	20	83,697	69,435	-11,704	28,793	170,221
Chart/CAGR		0.2%				4.3%

Table 3-3. Energy Forecast – Low Case (MWh)

Year	Year #	Baseline Forecast	Cumulative EV Adj.	Cumulative NM PV Adj.	Cumulative HP Adj.	Adj. Forecast
2024	1	80,964	391	-9,236	808	72,926
2028	5	81,633	2,177	-10,715	2,451	75,546
2034	11	81,641	9,311	-11,270	4,951	84,634
2038	15	82,474	14,629	-11,552	6,262	91,813
2043	20	83,697	17,359	-11,704	7,198	96,550
Chart/CAGR		0.2%				1.5%

to the base case. We assume that net metering penetration continues as forecast in the base case. At these growth rates, the market penetration for EVs and CCHPs reaches approximately 162% and 102% each in 2043. This rough estimate assumes that most households will have one or more CCHP and more than one electric vehicle. This is a reasonable high case given the fact that most homes require more than one CCHP if the entire home is to be served by the CCHP, and the average Vermont household currently has two vehicles. Therefore, this high case shows EV adoption approaching current combustion vehicle numbers. With these increases in electrification the CAGR increases to 4.3%. This growth rate results in a 222% increase over 2024 electricity use.

To form a low case, we assumed that the penetration for CCHPs and EVs is half of the base case, and we kept the net metered PV penetration rate the same as the base case. This results in a forecast that increases by 1.5% per year.

3.2 Peak Forecast Results

Tables 3-4 and 3-5 show the results of the baseline forecast of peak demand for the summer and winter periods, as well as the adjustments that are made to arrive at the adjusted forecast. The baseline forecast is decreasing by 0.2% per year for the summer period. After adjustments for CCHPs, EVs, and net metering, the adjusted forecast

Table 3-4. Summer Peak Demand Forecast (MW)

Year	Year #	Baseline Forecast	Cumulative EV Adj.	Cumulative NM PV Adj.	Cumulative HP Adj.	Adj. Forecast
2024	1	13.43	0.15	-0.02	0.22	13.78
2028	5	13.39	0.82	-0.01	0.67	14.87
2034	11	13.25	3.52	0.0	1.36	18.14
2038	15	13.45	5.54	-0.02	1.72	20.70
2043	20	12.56	7.91	0.0	1.78	22.24
CAGR		-0.3%				2.5%

Table 3-5. Winter Peak Demand Forecast (MW)

Year	Year #	Baseline Forecast	Cumulative EV Adj.	Cumulative NM PV Adj.	Cumulative HP Adj.	Adj. Forecast
2024	1	16.20	0.14	0.00	0.53	16.87
2028	5	15.59	1.21	0.00	2.63	19.43
2034	11	15.23	5.18	0.00	5.34	25.75
2038	15	15.59	8.14	0.00	6.75	30.48
2043	20	15.60	9.66	0.00	7.76	33.02
CAGR		-0.2%				3.5%

increases by 2.6% per year. The winter peak is decreasing by 0.3% per year. After making the same adjustments the forecast increases by 3.2% per year.

Peak Demand Forecast–High and Low Cases

To form a high case, we assume that neither load controls nor Time-of-Day (TOD) rates are implemented, and then we adopt the same assumptions from the high case as in the energy forecast. (Please note that WEC will use the term "TOD" rate throughout this IRP and in all public-facing documents going forward to make the new concept of time-varying rates more understandable and approachable to members. In recent testimony, WEC has used the term "Time-of-Use" (TOU) rate, which should be considered synonymous with TOD rates.)

Under these assumptions the winter peak reaches 50 MW and the summer peak reaches 31.1 MW by 2043.

A low case for the peak forecast would involve applying aggressive TOD electric rates[2] and load control devices on all of the major end uses, especially CCHPs and EVs. In theory, this strategy could offset any new peak demand growth, and peak demand would simply match the baseline forecast without any adjustments. As a result, it is not necessary to quantify a low case scenario.

Table 3-6. Winter Peak Demand Forecast - High Case (MW)

Year	Year #	Baseline Forecast	Cumulative EV Adj.	Cumulative NM PV Adj.	Cumulative HP Adj.	Adj. Forecast
2024	1	16.2	0.8	0.0	4.3	21.3
2028	5	15.59	2.5	0.0	7.0	25.1
2034	11	15.23	10.0	0.0	10.9	36.1
2038	15	15.59	18.2	0.0	14.5	48.3
2043	20	15.60	18.2	0.0	16.2	50.0

Table 3-7. Summer Peak Demand Forecast - High Case (MW)

Year	Year #	Baseline Forecast	Cumulative EV Adj.	Cumulative NM PV Adj.	Cumulative HP Adj.	Adj. Forecast
2024	1	13.43	0.7	0.0	1.1	15.2
2028	5	13.39	2.2	0.0	1.8	17.4
2034	11	13.25	8.4	0.0	2.7	24.4
2038	15	13.45	12.9	0.0	3.2	29.6
2043	20	12.56	15.2	0.0	3.3	31.1

2 WEC will use the nomenclature TOD rate throughout this IRP and in all public-facing documents going forward to make the new concept of time-varying rates more approachable to members; in recent testimony, WEC has used the term "Time-of-Use" (TOU) rate, which should be considered synonymous.

3.3 Tier III Impacts on the Forecast

The provisions of the Tier III Best Practices and Minimum Standards state:

"For a Retail Electricity Provider implementing Energy Transformation Projects that increase the use of electric energy, the Provider's Tier III annual plan shall include: (A) reference to the load forecast developed in the Provider's most recently Commission approved Integrated Resource Plan and any relevant updates to or major deviations from the assumptions used in that load forecast."[3]

Table 3-8 shows the measures from WEC's 2022 RES compliance. These loads are based on averages as published in the Tier III Planning Tool. 80% of the new electric loads are expected to come from EVs and CCHPs, the measures Itron included in the load forecast. The annual increase in load from heat pumps is similar to Itron's forecasted increase. However, the annual increase in load from electric vehicles is lower than Itron's forecast. Drive Electric Vermont shows that there are approximately 414 EVs registered in WEC's territory. This equates to over 2,000 MWh of increased load. This actually exceeds Itron forecast for the cumulative load increase from EVs as of 2024. All other Tier III measures have a negligible impact on peak demand and therefore are not included in the forecast

Table 3-8. Program Year 2022 Tier III Installed Measures

Measure	# of Measures
CCHP	240
EV	26
HPWH	37
PHEV	9
E-Bike	30
E-Mower	16
TOTAL	**358**

WEC agreed in the 2020 IRP MOU to model additional Tier III measures for this IRP; however, no significant new Tier III measures have come into play since 2020 that warrant (costly) changes to load forecasts. The technology forecast assumptions used here are congruent with VELCO's Long Range Plan and with other DUs, as well. Modeling additional technologies would not be a prudent use of limited utility resources.

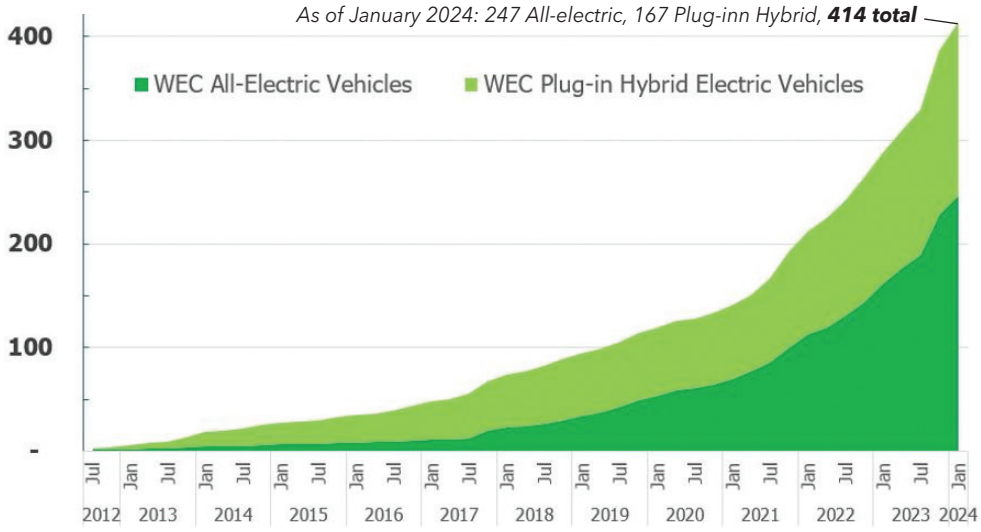
3.4 Forecast Uncertainties and Considerations

In 2023, WEC had almost 7,000,000 kWh of net metering generation. This is roughly equivalent to 11% of WEC's 2023 annual energy need, which is met by significantly more expensive energy. This level of net metering adoption, if it continues at current growth rates, erodes retail sales and shifts costs between members. Even if the growth rate slows, the long duration of net metering projects means that retail sales reductions and cost shifts will persist as a significant issue for WEC members.

Electrification, particularly in the form of electric vehicles and cold climate heat pumps, has been accounted for in the load forecast. However, actual adoption of these measures will likely vary. While there is the potential for adoption rates to vary substantially from the current forecast, particularly given the statewide push toward electrification, this variation will likely be at a rate that would allow WEC to adjust power supply resources so that the utility is not too short or too long on energy compared to load. WEC will also continue to update load forecasts, which will become more accurate as the new Advanced Metering Infrastructure (AMI) is implemented. WEC currently uses Power Line Carrier (PLC) AMI, but the system is limited by how much data it can carry and by the interference caused by other technologies, such as heat pumps and net metering. The Co-op plans to issue requests for proposals from AMI vendors in early 2024. [See Section 8.]

Figure 3-2. WEC Estimated EV Adoption

WEC Member Estimated Electric Vehicle Registrations



Source: Drive Electric Vermont, DMV registration data. WEC member attribution based on a percentage of residential utility accounts in each zip code

3 PUC Rule 4.415 (6)(A)

3.5 Forecast Methodology Details

The WEC long-term forecast is based on a bottom-up modeling framework where the forecast starts at the revenue class (e.g., residential, small commercial, and large commercial) with heating, cooling, and base-use sales derived from the sales models used to drive system energy and peak demand.

The system energy forecast is based on a linear regression model that relates monthly energy to monthly rate class sales. The baseline peak demand is derived from a monthly regression model that relates monthly peak demand to peak-day weather conditions combined with end-use estimates of heating, cooling, and non-weather sensitive loads from the customer class sales models. The same model structure is used for all VPPSA members, GMP, Burlington Electric, and VELCO.

Baseline sales models are estimated for each customer class. For WEC, this includes residential, small, and large commercial. Models are estimated using monthly linear regression models with historical billed sales and customer counts from January 2011 to December 2022. Sales and system load are "reconstituted" for embedded solar; past solar generation is added to historical sales and system load. Our objective is to model customer energy requirements: not just what is purchased from the utility. Model coefficients, statistics, and actual and predicted results are included in the Itron report in the Appendix.

The baseline forecast captures expected load growth before adjustments for new PV adoptions, electric vehicles, and cold climate heat pumps. Baseline sales are driven by customer growth projections, state economic forecasts, end-use efficiency (both due to standards and state efficiency program activity) and saturation projections and temperature trends. Residential and commercial models are estimated using Statistically Adjusted End-Use (SAE) model specifications. The SAE model integrates end-use saturation and efficiency trends that change slowly over time with variables that impact month-to-month sales variation and capture economic growth. This includes temperature as calculated by heating degree days (HDD) and cooling degree days (CDD), economic conditions (household income, employment, and state output), and demographic trends (population, number of households, household size).

3.6 Forecast Assumptions for Electric Vehicles

The electric vehicle (EV) forecast was developed by the VEIC as part of the VELCO 2024 Long-Range Transmission Plan. VEIC provided three forecast scenarios: low, medium, and high, based on saturation targets for light-duty registered vehicles. As noted above, the current rate of EV adoption by WEC members exceeds the statewide average. The forecast assumes the high case path as this is most consistent with experience and state mandates that all passenger car and light-duty trucks delivered by manufacturers for sale in Vermont meet the definition of zero-emission vehicles by 2035. In the high case, 90% of all vehicles are electric by 2050 with a 50% market share by 2030.

EV saturations are translated into number of vehicles and then total charging energy requirements based on estimated annual miles driven and kWh per mile driven. Figure 3-6 shows EV electric consumption. By the end of the forecast period, there is over 35,000 MWh of EV charging load.

State EV sales are allocated using the WEC share of the statewide number of residential ratepayers.

Figure 3-3. Electric Vehicle Projections

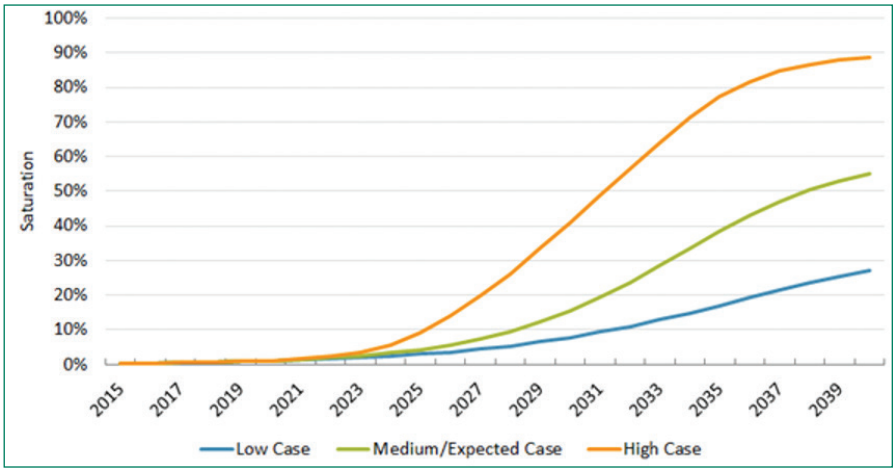
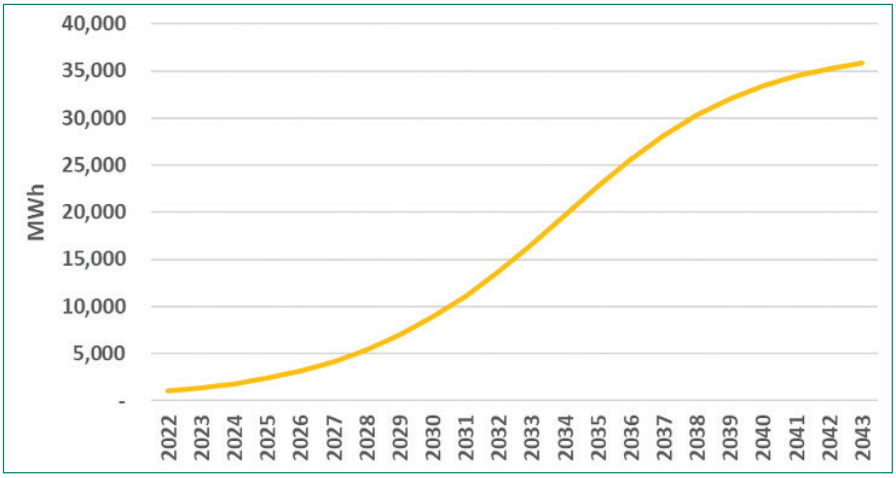


Figure 3-4. EV Electricity Forecast



3.7 Forecast Assumptions for Solar

The solar forecast is based on Itron's behind-the-meter (BTM) solar forecast developed also as part of the 2023 VELCO long-term forecast. BTM solar capacity is derived from an investment return-based model that relates installed capacity to average system payback (number of years before investment costs are recovered). Figure 3-7 shows state capacity forecast.

We expect the growth of BTM solar adoption to begin to slow by 2025 as system costs begin to flatten out. We project over 450 MW of installed solar capacity by 2032. This translates into nearly 650,000 MWh based on monthly load factors derived from Vermont solar generation profile data.

In 2022, WEC had roughly 7,600 MWh of solar generation. Our default assumption is WEC BTM solar generation continues to increase at the same rate as state generation projections. Like the state, solar generation in WEC territory is expected to slow significantly after 2025. Figure 3-8 shows the WEC solar generation forecast.

Figure 3-5. State Solar Capacity Forecast (MW)

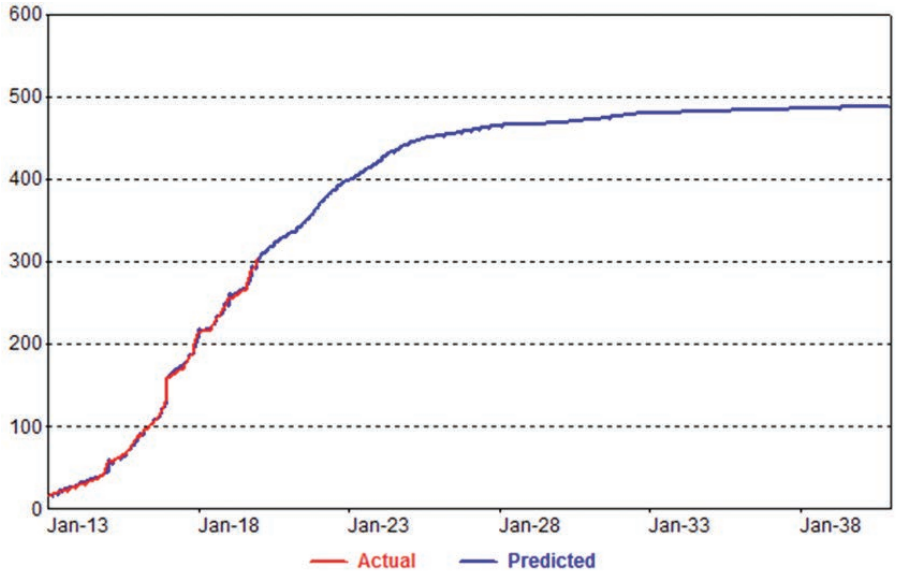
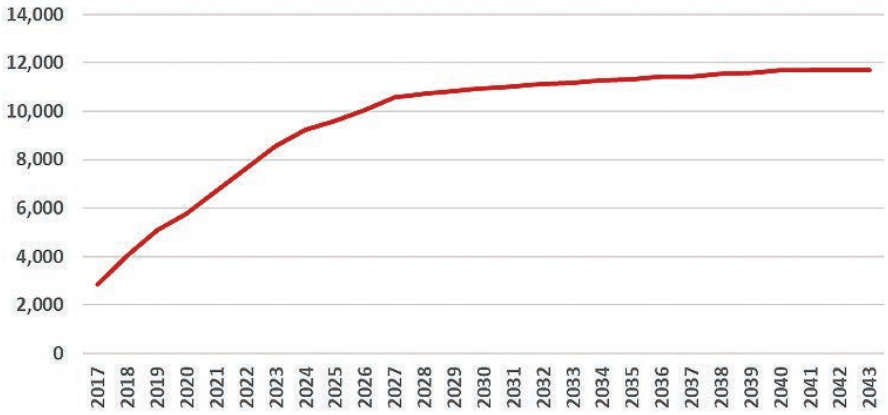


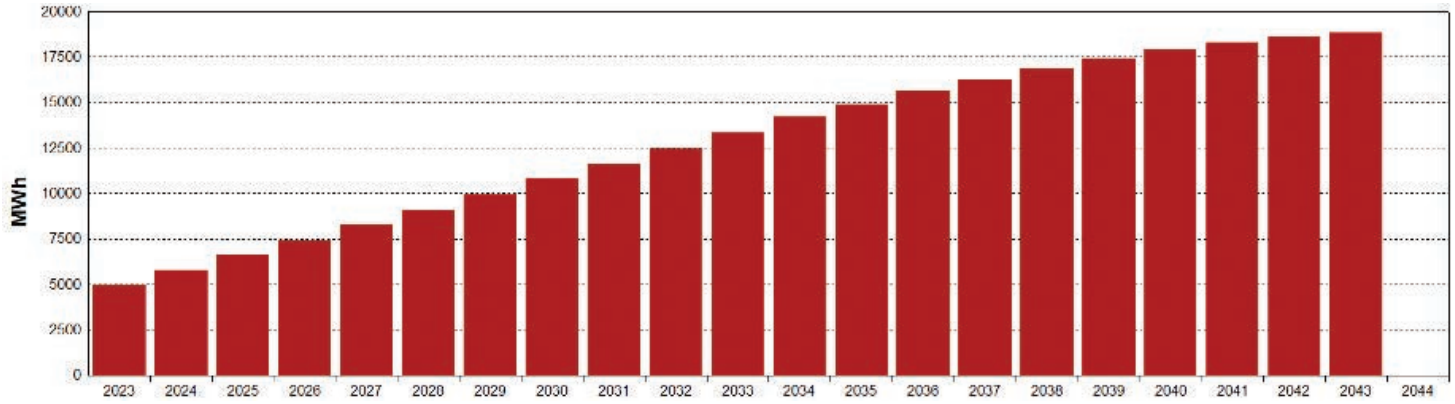
Figure 3-6. Expected Wec Solar Generation (MWh)



3.8 Forecast Assumptions for Cold Climate Heat Pumps

As part of state efforts to reduce CO2 emissions, the state has launched a program to promote CCHP by offering financial incentives including rebates and no interest financing. The primary targets are homes that heat with oil, propane, and wood. Over the last four years, the state has seen aggressive heat pump adoption with over 50,000 units installed. We expect to see continued strong heat pump adoption, with WEC heat pump adoption increasing proportionally to state projection, based on WEC residential customers relative to state residential electric customers. Figure 3-9 shows WEC heat pump sales projections.

Figure 3-7. Projected Heat Pump Sales



4. Power Supply

In the following section, WEC describes our current power supply portfolio and a brief consideration of potential future resource options. A more detailed consideration of potential future resource options will be described in Section 6: Resource Decision Analysis.

4.1 Power Supply Portfolios

The intent of the IRP resource modeling process is to provide important information about the costs, features, and risks of various power supply portfolios that WEC could use in the future to meet its system load requirements. The goal is to project cost and cost variance, emissions profiles, and other measures associated with each portfolio, under a broad range of future loads, market prices, economic conditions, and other factors affecting performance, such as market or regulatory changes. The IRP process is used to develop methods to evaluate competing future investments and purchase decisions.

WEC's power supply portfolio is made up of generation resources, long-term contracts, and short-term contracts. The portfolio acts as a diversified, financial hedge that buffers WEC and its member-owners from the cost and volatility of buying electricity from ISO-NE on the spot market at the Vermont Zone. The following sections describe each of the power supply resources in WEC's portfolio.

4.1.1 Coventry

Size: 8 MW

Fuel: Landfill Gas

Location: Coventry, Vermont

Entitlement: Coventry Clean Energy Corporation (a wholly owned WEC subsidiary,100%, owned)

Products: Energy, capacity, RECs (CTI, MAI, RII, NHI, VTI)

End Date: Lease with CCEC expires in 2036. WEC plans to renew.

Notes: This is WEC's largest energy-producing resource, and it provided 65% of WEC's energy in 2023.

4.1.2 HQUS

Size: 4.0 MW

Fuel: Hydro

Location: Highgate HVDC Converter Station

Entitlement: 0% Jan-May 2023 (PPA). 50% June-Dec 2023 (PPA) WEC may take 100% with notice to VEC.

Products: Energy, RECs (VTI)

End Date: 2038

Notes: Due to a 12-month average coverage ratio of less than 97%, WEC took back 2 MW of this contract from VEC starting in July of 2023.

4.1.3 New York Power Authority (NYPA)

Size: 11.8 MW (Niagara), 2.5 MW (St. Lawrence)

Fuel: Hydro

Location: New York State

Entitlement: 1.27 MW (Niagara PPA), 0.077 MW (St. Lawrence PPA)

Products: Energy, capacity, VT1 RECs

End Date: Assumed to continue through IRP period

Notes: NYPA provides hydro power to the WEC under two contracts, which will be extended at the end of their term.

4.1.4 Ryegate

Size: 20.5 MW

Fuel: Wood

Location: East Ryegate, VT

Entitlement: 1.41% (PPA)

Products: Energy, capacity, RECs (CT Class I)

End Date: October 31, 2032

4.1.4 Ryegate

Size: 40 MW

Fuel: Wind

Location: Sheffield, VT

Entitlement: 10% (PPA)

Products: Energy, capacity, RECs (CTI, MAI, RII)

End Date: October 18, 2031

4.1.5 Sheffield Wind

Size: 40 MW

Fuel: Wind

Location: Sheffield, VT

Entitlement: 10%, (PPA)

Products: Energy, capacity, RECs (CTI, MAI, RII)

End Date: October 18, 2031

4.1.6 Wrightsville

Size: 0.933 MW

Fuel: Hydro

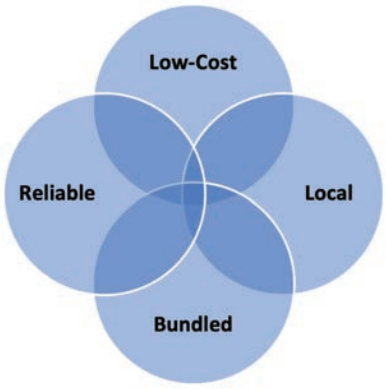
Location: Montpelier, VT

Entitlement: 100%, owned

Products: Energy, capacity, RECs (VTI)

End Date: Life of unit

Figure 4-1. Resource Criteria



- **Low-Cost** resources reduce or stabilize electric rates.
- **Local** resources are located within WEC's service territory and within the ISO-NE region.
- **Bundled** resources meet or exceed RES requirements with bundled energy and RECs.
- **Reliable** resources not only provide operational reliability but are also owned and operated by financially strong and experienced companies.

4.2 Future Resources

WEC will seek out future resources that meet as many of the following criteria as possible. Ideally, future resources will meet four criteria: low-cost, local, renewable, and reliable.

Resources that WEC may consider fall into three categories: 1. Existing or expansion of resources. 2. Demand-side resources, and 3. New resources that meet the criteria in Figure 4-1.

Category 1: Extensions or Expansion of Existing Resources

Resources that can be extended beyond the current expiration include NYPA, HQUS, and Sheffield Wind. NYPA's current expiration is 2032, but it is assumed in this IRP that the contract will be extended through the end of the IRP period. HQUS can not only extend the existing expiration date, but additional volume can be pulled back from the volume that is currently passed through to Vermont Electric Cooperative (VEC). This can happen if WEC's average coverage ratio falls below 97% for a 12-month period. WEC already took advantage of this aspect of the HQUS passthrough to VEC and pulled back 50% of the contract volume starting in June of 2023. This is an excellent option, as this resource is already contracted and it fulfills three of the four resource criteria.

It may also be possible to expand WEC's existing Coventry Landfill Gas to Energy Plant by installing one or more additional units. This is a baseload renewable resource that is located within Vermont and is owned by WEC. Therefore, this resource falls under all four categories in Figure 5 and is a good option for expansion. However, the impact of the plant being in the SHEI transmission constrained region must be taken into account. Additional transmission capacity which may come on line, or installation of a battery storage capacity at the location could reduce these impacts. Of course, WEC would also need the support and partnership of the landfill operator in order to do such an expansion.

Category 2: Demand-Side Resources

WEC actively engages with Efficiency Vermont to ensure that Co-op members are aware of all demand-side management (DSM) programs and services provided by the state's energy efficiency utility. WEC is also actively exploring how home-based battery storage and flexible load management can be scaled as a cost-effective DSM resource. [See more discussion in Section 5]

Table 4-1. WEC Resources

Resource	2024 MWh	% of MWh	2024 MW	Delivery Pattern	Price Pattern	Rec	Expiration Date
Coventry Landfill	52,258	59.9%	8.00	Baseload	O&M and Fixed Fuel Cost	Yes	Life of Unit
HQUS	11,712	13.4%	2.00	7x16	Fixed	Yes	10/31/2038
NYPA	11,469	13.1%	1.30	Baseload	Fixed	Yes	12/31/2043
Ryegate	2,189	2.5%	0.29	Baseload	Fixed	Yes	10/31/2032
Sheffield Wind	7,853	9.0%	4.00	Intermittent	Fixed	Yes	10/18/2031
Wrightsville	1,780	2.0%	0.93	Run of River	O&M Only	Yes	Life of Unit
Total	87,261	100.0%	16.52				

Category 3: New Resources

VPPSA regularly meets and maintains communications with developers throughout New England. Through VPPSA staff, WEC will continue to monitor and evaluate new generation resources in the New England region.

WEC is currently in the early stages of discussions with multiple battery storage developers for a utility-scale system. The location of the project is yet to be determined. An economic analysis will be evaluated. A completion date is not yet known.

Section 6 includes more details and considerations about power supply options for the future.

4.3 Procurement Process

- **Monthly process**
  VPPSA reviews WEC's ratio of supply to demand, known as the hedge ratio or coverage ratio, on a monthly basis. WEC's existing resources are typically enough to have a coverage ratio that is equal to or greater than 100% except in the winter months. On a monthly basis, generally, WEC prefers to have a slightly open position rather than hedging. Therefore, it is uncommon for WEC to engage in short term market purchases to achieve a hedge ratio closer to 100%.

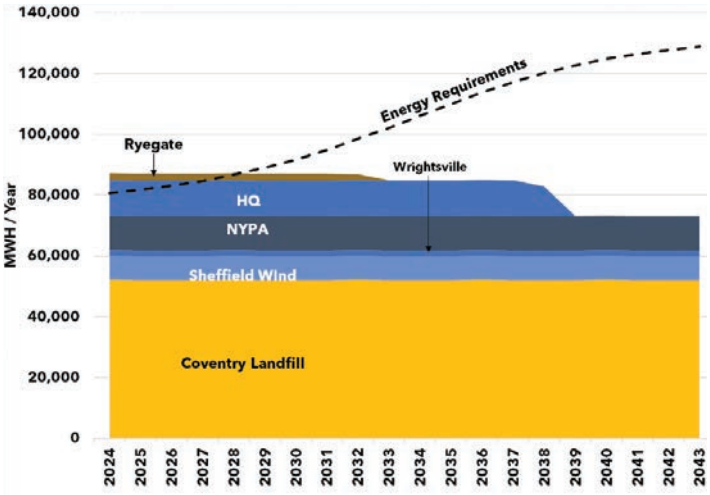
- **Annual Process**
  In order to maintain 100% renewability, WEC must ensure the utility has enough bundled energy and REC contracts or owned generation to cover load. Although this is an annual metric, VPPSA tracks this on a monthly basis and can make adjustments via monthly or annual contracts. Part of this process is tracking the 12-month coverage ratio to maintain a 97% ratio or higher. If the coverage ratio drops below 97% for a 12-month period, that triggers the ability for WEC to take back part or all of the HQUS power that currently gets passed through Vermont Electric Cooperative (VEC). WEC took advantage of this process in 2023 and took back 2 MW of the 4 MW contract.

- **Long-Term Process**
  WEC utilizes long-term resources for the vast majority of power supply needs. Occasionally, as stated above, short-term resources are obtained to maintain 100% renewability. WEC's largest resource is the owned Coventry Landfill plant. WEC is focused on utilizing existing long-term resources to fulfill power supply needs, as they meet most or all of the characteristics in Figure 4-1 that are important to WEC and WEC's members. Long-term resources, whether they are Purchased Power Agreements (PPAs) or owned resources such as Wrightsville and Coventry, are evaluated for economic merit. Regarding PPAs, because long-term contracts are subject to PUC approval, the acquisition strategy is simply to negotiate the best terms and to make the contract execution contingent on PUC approval.

4.4 Energy Resource Plan

Figure 4-2 compares WEC's energy supply resources to its adjusted load. The supply resources closely match demand through 2028. While resources mostly remain the same, the forecasted load increases quickly, which causes energy demand to outpace anticipated generation.

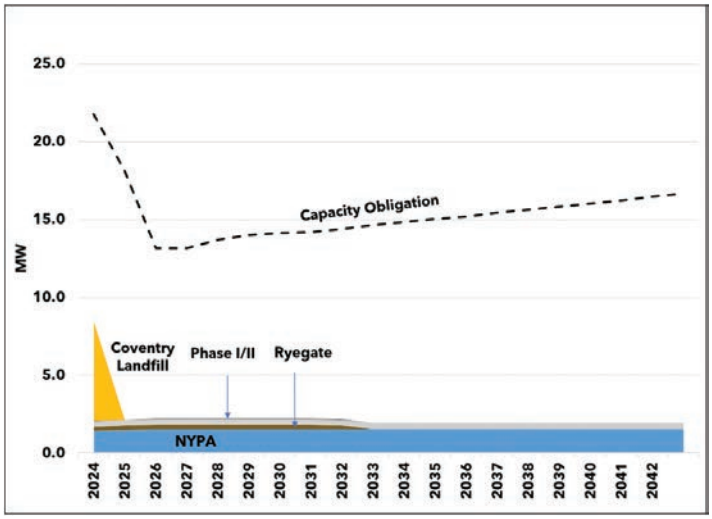
Figure 4-2. Energy Supply and Demand By Fuel Type



4.5 Capacity Resource Plan

Figure 4-3 compares WEC's capacity supply to its capacity supply obligation (CSO). The CSO is equal to WEC's coincident peak demand with ISO-NE plus a reserve margin. As a result, the CSO is higher than the Adjusted Peak Demand Forecast. WEC's CSO drops by about 9 MW from 2024 to 2026. This is because the Coventry Landfill resource is going behind the meter in June 2024. This will reduce WEC's CSO beginning halfway through calendar year 2025.

Figure 4-3. Capacity Supply and Demand (Summer MW)



The Coventry unit comprises 25-33% of WEC's current CSO. Therefore, as Coventry goes behind the meter and becomes a load reducer, the reliability of Coventry, particularly at peak hours, is key to minimizing WEC's capacity costs as well as minimizing effects of electrification on peak demand.

4.6 Renewable Energy Standard (RES 1.0) Requirements

WEC is a 100% renewable utility, which means the utility must retire enough renewable energy credits (RECs) to cover 100% of retail sales. It also means that WEC doesn't have a volumetric Tier II obligation. The obligation for Tier II is to implement a net metering program for members and retire those RECs on behalf of members. WEC's 100% renewability does not affect the Energy Transformation (Tier III) obligation, however. That information is shown in Table 4-3. Note that this plan assumes that Tier III requirements are maintained at their 2032 levels throughout the rest of the study period.

Table 4-2. RES TIER III Requirements (Percentage of Retail Sales)

Year	Tier III: Energy Transformation
2024	6.67%
2025	7.33%
2026	8.00%
2027	8.67%
2028	9.33%
2029	10.00%
2030	10.67%
2031	11.33%
2032	12.00%
2033-43	12.00%

Because it is designed to reduce fossil fuel use, the Tier III requirement is fundamentally different from Tier I requirements. Unlike the Tier I requirements–which count only electricity that is produced and consumed in an individual year –Tier III programs account for the "lifetime" of fossil fuel savings. For example, if a Tier III program installs a cold climate heat pump (CCHP) in 2024, the fossil fuel savings from that CCHP are counted such that the full 15 years of the CCHP's expected useful life accrue to the 2024 Tier III requirement.

The RES statute provides a second way to comply with its requirements: the Alternative Compliance Payment (ACP). In the event that a utility has not achieved the requisite amount of Tier I, Tier II, or Tier III credits in a particular year, then any deficit is multiplied by the ACP, and the funds are remitted to the Clean Energy Development Fund (CEDF).

However, utilities with a RES deficit may also petition the Public Utilities Commission (PUC) for relief from the ACP, or they may petition the PUC to roll the deficit into subsequent compliance years. As a result, there are multiple ways to comply with RES requirements.

Table 4-3. ACP Prices[5] ($/MWH)

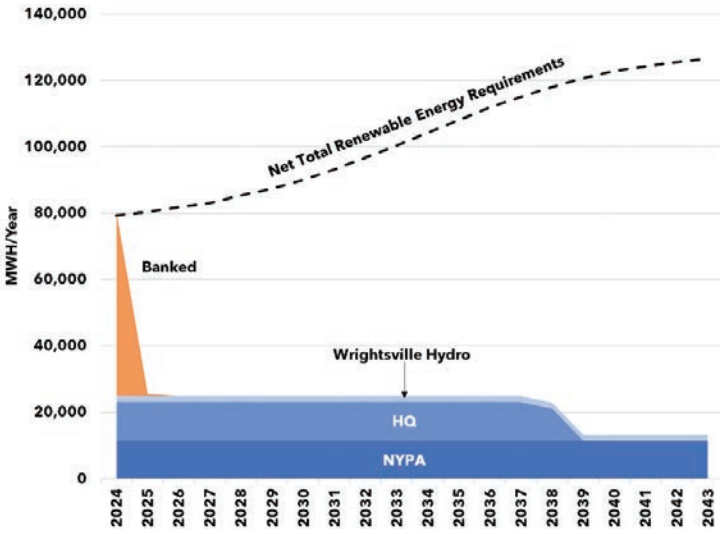
Year	TIER I	TIER III
2024	$12.28	$73.70
2025	$12.53	$75.17
2026	$12.78	$76.68
2027	$13.03	$78.21
2028	$13.29	$79.78
2029	$13.56	$81.37
2030	$13.83	$83.00
2031	$14.11	$84.66
2032	$14.39	$86.35

5 Please note that 2024 is known but following years are estimates and grow at inflation.

4.7 Tier I: Total Renewable Energy Plan

The primary energy resource contributors to Tier I are HQ, NYPA, and Wrightsville. WEC typically purchases between 50,000 and 55,000 Tier I RECs annually to be able to retire enough RECs to achieve 100% renewability. The need to enter into REC-only purchases will continue in perpetuity. The price of Tier I RECs has varied substantially from $0.25 to over $11 per REC. Current prices for 2024 vintage are between $2 and $3. At those prices, assuming gradual increases year on year, complying with Tier I between 2028 and 2032 could be as much as $354,000 annually. If the cost increased again to the $11 range and grew with inflation, the cost could be as high as $2.2 million annually in the outer years of this IRP.

Figure 4-4. TIER I – Total Renewable Energy Supplies

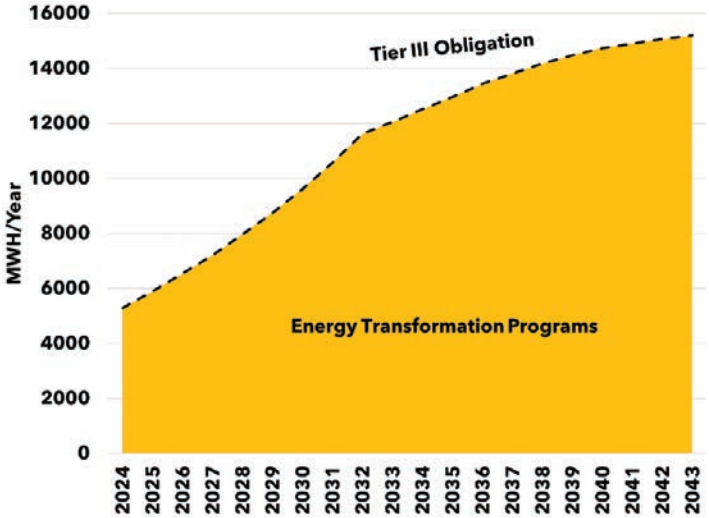


4.8 Tier III - Energy Transformation Plan

The dashed line in Figure 4-5 shows WEC's Energy Transformation (Tier III) requirements, which rise from about 5,300 MWH in 2024 to over 15,000 MWH in 2043– which assumes the 2032 obligation percentage will remain constant at 12% of retail sales in perpetuity. Notice WEC's obligation continues to rise quickly even after 2032, despite the percentage of retail sales remaining at 12%. This is because WEC's load is expected to continue to increase substantially in this time.

Prescriptive programs, as well as the Capstone program, are presently budgeted to fulfill the entire requirement and are shown in the yellow-shaded area. These programs cover a range of qualifying technologies, including EVs, CCHPs, heat pump water heaters (HPWHs), and weatherization. In regard to PUC Rule 4.410(3), WEC's entire portfolio of Tier III measures uses deemed savings calculations as agreed upon in the State Screening Tool developed as part of the Tier III Technical Advisory Group. No further analysis is conducted or expected to be performed given WEC's predominantly residential membership base, and any further analysis would not be a prudent use of limited resources. More detail on these programs can be found in WEC's annual Tier III plan filings.

Figure 4-5. Energy Transformation Supplies

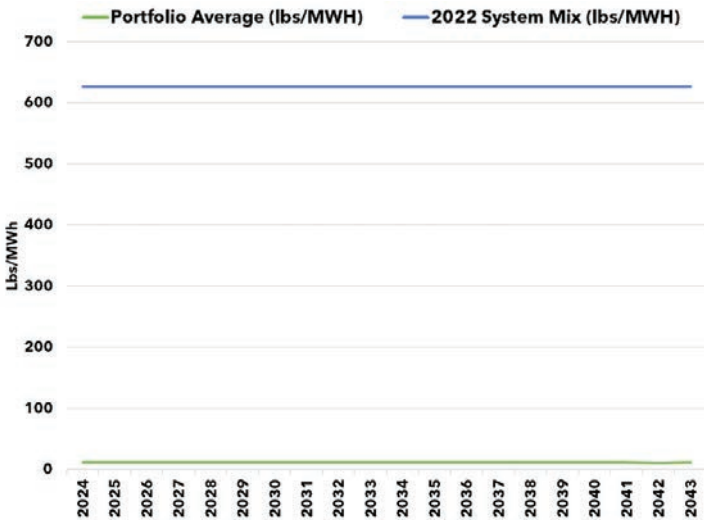


If prescriptive programs do not fulfill the entire requirement in the future, custom Tier III projects will be contemplated to fill the gap. Additionally, WEC will continue to manage Tier II credits to maximize value across both Tier II and Tier III requirements. WEC balances its use of these credits across obligations to accomplish several goals. First, to make sure that we do not let credits expire and therefore waste member money spent on achieving these goals. Second, to allow us time and opportunity to fine tune our incentives in order to achieve the objective investment by members while spending efficiently to allow us to offer incentives to as many as possible. Third, to achieve the goals of decreasing use of fossil fuels.

4.9 Carbon Emissions and Costs

Figure 4-6 shows an estimate of WEC's carbon emissions rate compared to the 2022 system average emissions rate from New England and imported resources[6]. The emissions rate in 2024 is about 11 lbs/MWH.

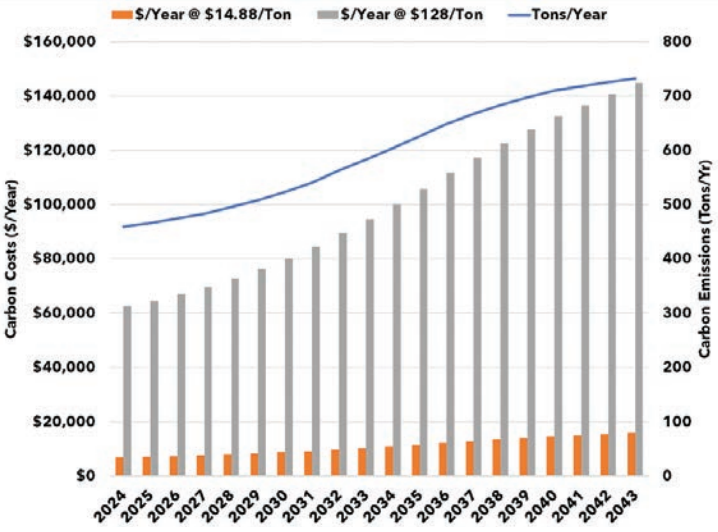
Figure 4-6. Portfolio Average Carbon Emissions Rate (Lbs/MWh)



The emissions rate remains constant throughout the IRP period because WEC's REC retirement percent doesn't change throughout the IRP period.

These emissions rates were multiplied by forecasted Total Load Including Losses to arrive at an estimate of carbon emissions in tons per year. The following figure shows that carbon emissions range from about 460 tons/year in 2024 to 562 tons per year in 2032.

Figure 4-7. Carbon Emissions (Tons/Year) and Costs ($)



6 The source of this data is the NEPOOL GIS. https://www1.nepoolgis.com/

The costs of these emissions were calculated using two sources: the Regional Greenhouse Gas Initiative Auction (RGGI) results for the most recent auction ($14.88 per ton), and the 2021 Avoided Cost of Energy Supply (AESC) study ($128 per ton in 2021). Using RGGI prices plus inflation, the cost of carbon emissions averages about $10,960 per year through 2043. Using AESC prices, plus inflation, the average cost through 2043 is about $100,000 per year.

4.10 Procurement Plan for Res 1.0

Under RES 1.0 requirements, WEC can continue to purchase Tier I RECs only to fill in the gaps in Tier I RECs received through the power supply portfolio. This IRP assumes Wrightsville is continuing to be operational and NYPA is extended through the IRP period. This IRP also assumes WEC does not pull back additional volume of HQ from VEC. Therefore, the volume of RECs that need to be purchased from 2024 through 2038 increase only based on forecasted increasing retail sales. However, once HQ expires in 2038, a larger volume of Tier I RECs will need to be purchased.

4.11 Resource Plan Observations

Tier I

WEC is meeting its Tier I requirements primarily with annual REC-only purchases as well as existing resources. As existing resources expire, WEC can enter into bundled energy and Tier I REC contracts, or WEC can continue to enter into large, REC-only purchases.

In this IRP, it is assumed that the only change to WEC's obligation in a new RES bill is the creation of a new renewable regional tier (Tier I.a.). This tier requires that any load growth above 2024 load will be obligated to be met with 50% new renewable in 2025, 75% new renewable in 2026, 90% new renewable in 2027, and 100% new renewable in 2028. The level will remain at 100% for new load growth until total load exceeds 135% of 2022 annual load, at which point additional load growth beyond 135% of 2022 load will be met with 50% new renewable until 2035. From 2035 on, 100% of new load between 2024 load and 135% of 2022 load is met with 100% new renewables, and 75% of new load above 135% of 2022 load will be covered by new renewables. Excess generation from earlier net metering systems can also count towards this obligation under the bill as currently drafted, as does the additional 2 WM of HQUS power WEC currently sends to Vermont Electric Cooperative, provided WEC were to retain that power starting by 2028. Load is also defined as Total Load Including Losses.

Tier II

As a 100% renewable utility, WEC continues to be exempt from a Tier II volumetric obligation. This exemption would remain under the proposed bill.

Tier III

Tier III requirements continue to be met with the Capstone and prescriptive programs or with banked Tier II credits.

5. Modernization and Innovation

5.1 AMI Migration from PLC to RF

WEC plans an extensive upgrade to its advanced metering infrastructure (AMI) system. Once installed, this new equipment will modernize data collection, reduce the need to dispatch personnel and equipment due to interference on the current system, provide the capability to utilize time of day rates, and most importantly, allow WEC staff to better manage outages and to provide more timely and accurate information to members about storm restoration efforts. Although a proposal and vendor has not yet been selected, the new AMI system is anticipated to be a radio frequency (RF) mesh system which will allow direct communication between meters and allow backhaul of information to WEC. Based on vendor conversations, it is anticipated that this system will allow close to 100 percent coverage of WEC's territory given improvements in the RF technology. It is possible this system will incorporate meters which can communicate either through member WIFI and fiber connections as well as through RF signals, but this will depend on vendor and price. These significant improvements are priorities for both members and regulators.

WEC's current meters use a power line carrier (PLC) to communicate member usage data. But this system is severely limited in how much data it can transmit. Moreover, interference, caused by other technologies such as heat pumps and DC inverters in net metering locations, limits how much data it can carry and hinders the WEC operations group from properly identifying outage locations and restorations.

There are a variety of benefits that WEC intends to gain from the RF Mesh AMI system implementation:

- Provide more efficient response to outage and restorations
- Collect more frequent interval data to support cost of service and rate design, including the implementation of TOD rates
- Offer energy programs for customers to help better manage their usage and costs
- Increase customer engagement in their use of electricity, including detailed consumption data
- Plan future capital investment strategies
- Comply with future regulatory and legislative requirements
- Reduce cost of non-pay disconnect/reconnect, move-in/out (off-cycle reads)
- Manage remote operation of devices in the field better
- Improve billing and customer care services
- Identify and reduce theft of service
- Improve system planning capabilities and generation
- Support increased adoption of solar generation and net metering
- Aim for a modern electric grid with integrated distributed energy resources (DERs) – e.g., electric vehicles, heat pumps, smart appliances, storage, and generation

WEC is exploring all avenues to help fund this important project, including state and/or federal grant dollars, as well as a loan from the Rural Utilities Service (RUS). We anticipate selecting a vendor for an AMI system in 2024. This is a major project for a small utility with a relatively large and rugged service territory, so WEC forecasts a four-year implementation phase.

5.2 Rate Innovation

As of Q1 2024, WEC is undergoing a Cost-of-Service Study, which is a critical step to begin to provide members with innovative rate options. As noted earlier, the AMI system changeout will allow WEC to have the capability to provide time-of-day (TOD) rates or other innovative rates in the near future. The success of WEC's TOD rate is dependent on the AMI upgrade project noted in the previous section.

The Legislature [Act 55, 2021 session] ordered Vermont utilities to develop rates to manage loads and promote adoption of plug-in electric vehicles (PEV). The Vermont PUC set a June 2024 deadline for utilities to implement a PEV rate. WEC has requested an extension for this deadline in case 23-3607-PET.

The Co-op is committed to giving its members more control over their electric use, whether it's charging their vehicles, using cold climate heat pumps, or in-home battery storage. This will benefit members by reducing their costs for high usage beneficial electrification applications and will benefit the Cooperative by allowing it to influence when times of high usage occur.

In order to prepare to implement TOD rates, the Co-op plans to use surveys in its bi-monthly newsletter to identify members who charge their EVs at home. It will further analyze bills to determine significant increase in individual residential load. This analysis, combined with Tier III recipient data, will ensure WEC is doing what it can to implement TOD rates when the new AMI rollout is complete, as suggested by the DPS.

5.3 Communication to Substations/ Devices/SCADA

In order to more accurately monitor the load and generation in real time across the WEC system Supervisory Control and Data Acquisition (SCADA), monitoring is recommended on each circuit. More accurate data could determine if a circuit needs to be de-energized for an extreme regional loading event. It can also more accurately determine when an upgrade is needed and can be used to determine if feeder backup is a viable option without risking other members being taken out of service. However, two considerations must be taken into account when determining whether such a system were to be deployed and how broadly it would be deployed, the price which would be imposed on WEC and ultimately on its members, and the ability of the Co-op to be able to effectively and efficiently use such a system.

All WEC substations are scheduled to be connected with VELCO fiber in 2024. This will give the Cooperative insight, but not yet full control, over those substations. Over time we will likely need to add the ability to control the devices at those substations and other devices on our network, as well as assets—notably battery storage—not yet deployed in our system. This will allow better management of outages, as well as quicker, more efficient, and more rapid management of devices in day-to-day operations. However, in order to gain control over existing assets devices will need to be updated or replaced.

5.4 Battery Storage

WEC members are currently installing behind the meter storage at unprecedented rates, and WEC is assessing the feasibility of hosting a "bring your own" battery program, as well as a battery leasing program. WEC anticipates leveraging Energy Storage Access Program (ESAP) grant funds alongside its project partners to invest in customer-sited battery energy storage. One program design contemplates the installation, deployment, and dispatch of battery energy storage systems for income-qualifying members. The second program design is expected to include dispatchable capacity through energy storage system installations at municipally owned buildings, with at least one WEC site focused on resilience and shared community benefit.

On a larger scale, fellow distribution utilities in Vermont are currently leasing utility scale batteries, and others own these batteries outright. WEC is currently in discussions with battery storage developers to assess the value of these options to the Co-op, including consideration of the ability (or lack thereof) to defer substation upgrades and the quantification of reduced peak-related costs. While substation-based batteries could help in a limited way with resilience, for instance if transmission lines to WEC substations were de-energized, these outages do not typically last more than a few hours. In addition, the Co-op's territory is not well suited to micro-grids, as areas with even modest density tend to be served by others. However, such battery storage solutions might be justified based on their ability to reduce peak costs, or perhaps to lessen the scale of needed system upgrades even if they did not eliminate that need.

5.5 Flexible Load Management

The main value stream associated with Flexible Load Management (FLM) is created when a utility is able to reduce its peak-related costs. Some ancillary service benefits can be derived from certain technologies, and energy arbitrage is another, albeit much smaller, value stream. Attributing value to other benefits, such as deferring capital investments, has yet to be proven and widely accepted by the utility engineering community. With this said, the peak-related benefits (avoided costs) of an FLM endeavor must be matched with total implementation costs that are lower, in order for a utility to justify economically prudent investments in FLM.

WEC members continue to install more devices that are connected, and in doing so, the sunk cost of load control devices is borne by the member. This is an opportunity for WEC to leverage members' behind-the-meter investments in order to more cost-effectively share in the value of moving energy out of costly peak times. Both beneficial electrification measures, as well as more traditional electric appliances with new scheduling and/or remote connection capabilities, have the potential to now act like grid assets and participate in FLM. WEC has been working on different iterations of FLM programs for many years, and the most recent rendition of this program is called PowerShift.

PowerShift is a collaboration between Efficiency Vermont and WEC (and more recently, VPPSA), and this program is testing low-cost ways for WEC members to voluntarily manage the peak demand of their devices. PowerShift started as a water heater program, working with both electric resistance and heat pump water heaters, and now, the program focuses solely on EVs.

WEC looks forward to learning from the cold climate heat pump FLM pilots taking place in Vermont, and is also researching how behind-the-meter batteries might make economic sense for the Co-op.

Regardless of the type of technology, FLM efforts are met with a myriad of challenges, including device communications interoperability, significant per-device data costs, increased staff time required to maintain device connection, and peak demand forecasting complexity, among others. However, the single largest barrier for WEC in this fledgling marketplace is associated with up-front and ongoing costs to aggregate devices via a common dashboard or aggregation service. Many software providers (SaaS or DERMS or aggregation) are requiring that utilities have minimum device counts greater than WEC has members, which is a significant impediment to WEC creating cost-effective FLM programs.

To begin to address these cost challenges, WEC anticipates leveraging the Energy Storage Access Program

(ESAP) grant funds, alongside its project partners, to "implement a common, multi-device, software solution for storage and flexible load management (FLM). The Applicants believe there is value in working together to avoid duplicated work, increase load flexibility and dispatchable resource portfolios, reduce software licensing expenses, acquire similar energy management capabilities, and leverage collective bargaining power."

Because of the numerous challenges and complexities noted above, WEC intends, over the next few years, to work toward the implementation of an innovative TOD rate that will serve as a backstop for FLM. A TOD rate will allow customers to bring whatever devices they choose to realize the monetary benefits of moving energy use outside peak times. This basic price signal will allow WEC members to remain autonomous in the controls of their devices, and the TOD rate will be a relatively simple communication to members about when to schedule their devices, or not, depending on their personal economic preferences. WEC will monitor members' use of a TOD rate to see if enough are participating to make such a rate valuable. [See more in Section 5.2, Rate Innovation.]

Finally, WEC is participating in Case No. 23-4345-PET, a proceeding to convene a flexible load management working group to address statewide needs, goals, and outcomes. The results of this case will help inform WEC's FLM strategy in the coming years.

6. Resource Decision Analysis

6.1 Resource Analysis

WEC's power supply is made up of owned generation and long-term contracts. The resources in WEC's portfolio are 100% renewable, and about two-thirds come from the Coventry Landfill Plant. Every year WEC's power supply portfolio provides excess energy which hedges against the cost of serving load in ISO-NE's energy, capacity, and ancillary markets. These power supply resources are summarized in Table 6-1.

Energy, capacity, and Renewable Energy Credits (RECs) are the primary products that WEC needs to manage, and the following sections illustrate the forecasted balance between their supply and their demand over the next five to ten years.

Figure 6-1 shows the current forecast of energy supply and demand for the next five years. WEC is a winter peaking system. Because its energy demand increases in the winter, WEC is about 1.9 MW short during these months. WEC typically chooses to leave this short position open and purchase energy on the spot market.

Figure 6-1. Energy Supply and Demand

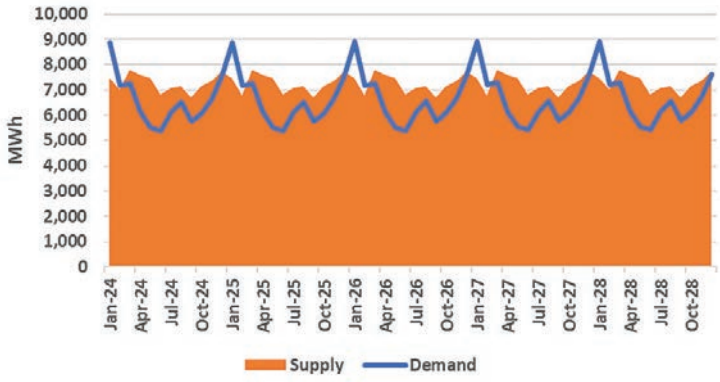
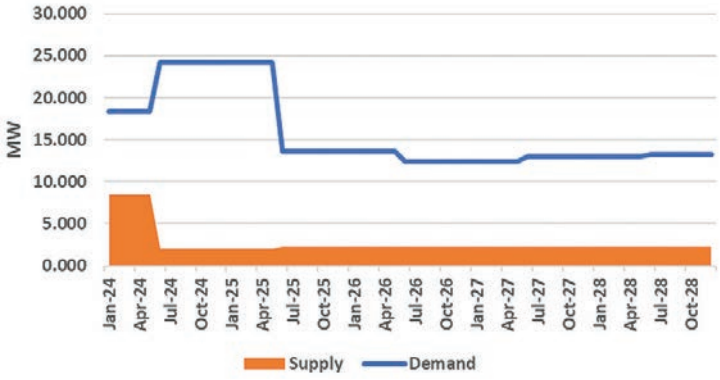


Figure 6-2. Capacity Supply and Demand



Capacity Considerations

Figure 6-2 shows the capacity supply and demand balance for the next five years. Starting in June 2024, Coventry becomes a load reducer, and will no longer receive credit through ISO-NE's capacity market. However, the benefits of Coventry as a load reducer won't be seen until June of 2025. As a result, there is a one-year period where WEC is forecast to experience a larger capacity deficit.

Thereafter, the deficit shrinks somewhat because of Coventry's load-reducing impact. As a result, the plant operators must take extra care to ensure the plant is

Table 6-1. 2023 Electricity Supply Resources

Resource	2023 MWH	%	Fuel	Exp. Date
Coventry Landfill	51,756	65%	Landfill Gas	Life of Unit
HQUS Contract	6,848	9%	Hydro	10/31/2030
NYPA Niagara Contract	10,131	13%	Hydro	4/30/2032
NYPA St. Lawrence Contract	336	0%	Hydro	4/30/2032
Ryegate Facility	2,271	3%	Wood	10/31/2032
Sheffield Wind	6,044	8%	Wind	10/18/2031
Wrightsville Hydro	2,296	3%	Hydro	Life of Unit
TOTAL RESOURCES	**79,682**	**100%**		

operating at full capacity during the peak hours of the summer months to reduce WEC's peak load and, therefore, capacity supply obligation as much as possible.

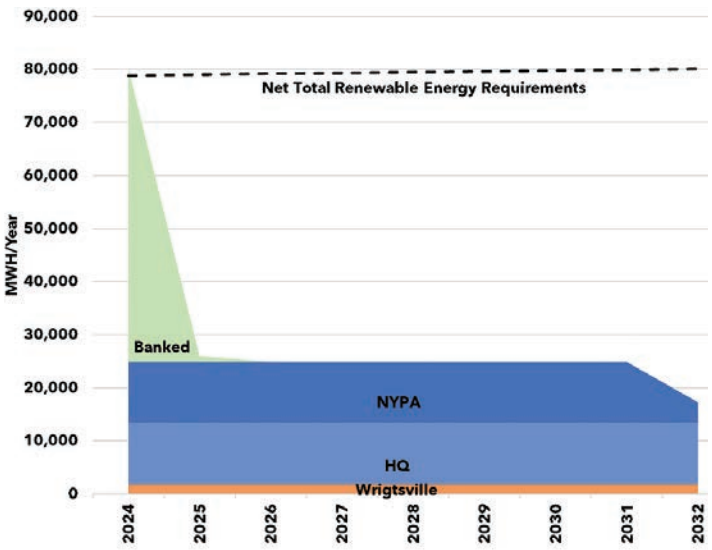
Renewable Energy Credits

WEC is exempt from Tier II requirements because it maintains a 100% renewable power supply under Tier I.

Figure 6-3 illustrates WEC's need for RECs to achieve 100% renewability. Because WEC sells RECs from Coventry, Ryegate and Sheffield, it must purchase Vermont Tier I RECs to maintain a 100% renewable power supply. In a typical year, WEC anticipates purchasing 55,000-63,000 MWH/year of Tier I RECs for this purpose.

WEC is exempt from Tier II requirements because it maintains a 100% renewable power supply under Tier I.

Figure 6-3. Vermont Tier I Supply And Demand



6.2 Resource Decisions

6.2.1 HQUS takeback

WEC has the option of taking back additional HQUS power from VEC should WEC's 12-month rolling average coverage ratio drop below 97%. WEC took back 2 MW starting in June 2023.

The most straightforward option to account for increased load and reduced coverage ratio is to take back up to the entirety of the remaining 2 MW of the HQUS contract from VEC. This is a good option not only because it's already under contract and just needs tracking of WEC's coverage ratio, but also because it fulfills three of the four characteristics of Figure 4-2 that WEC seeks in resources. This resource also provides Tier I RECs.

6.2.2 Expand Coventry Landfill Gas to Energy Plant

WEC's largest resource is Coventry Landfill. It is also WEC's largest owned resource which, beginning in June 2024, will be behind the meter and, therefore, create more value through capacity and transmission benefits. Increasing the number of generators at the plant will not only increase the energy generated but will help WEC with increased peak demand due to electrification.

6.2.3 Resource Decision 3: Battery Storage Contract (ESSA)

Utility scale battery storage is one method to manage transmission costs and address load control, and WEC is collaborating with a storage developer to develop one or more sites. If successful, this resource will likely be procured through a multi-year Energy Storage Service Agreement (ESSA). Table 6-2 summarizes the energy resources decisions WEC faces in the coming five to ten years.

6.3 Other Resource Decisions

Alternatives to these decisions can be envisioned. For example, WEC could enter into additional bundled energy and REC contracts that would both ensure 100% renewability.

6.4 Coventry Future

WEC is considering expanding the existing Coventry landfill gas generator by installing as many as five additional units. Depending on need, market conditions, and costs, the expansion could likely be phased in over a two- to ten-year timeframe.

Starting in June 2024, Coventry becomes a load reducer, and will no longer receive credit through ISO-NE's capacity market. However, the benefits of Coventry as a load reducer won't be seen until June 2025. As a result, there is a one-year period where WEC is forecast to experience a larger capacity deficit.

Table 6-2. Energy Resource Decision Summary

Resource	Years Affected	% of MWH	Rate Impact	RES Impact
Extend HQUS Takeback	2031 - 2038	11.8%		Tier I
Expand Coventry	2026-life of unit	15.6%		None
Storage ESSA	2027 – 2046	% of peak	Decrease	None

6.5 RECs

WEC's renewable generation and retail sales are reviewed monthly to ensure WEC remains 100% renewable. If that renewable energy to load ratio begins to show load increasing beyond generation, a contract for bundled renewable energy and REC purchase will be made.

6.6 REC Acquisition Strategy

WEC generates more renewable energy via generating assets or PPAs than it requires every year. WEC sells the high value RECs associated with that generation, typically in the MA1, CT1, and RI1 markets. Therefore, WEC must purchase VT1 RECs to retire and remain 100% renewable. The REC acquisition strategy has three parts:

1. VPPSA completes an analysis of Tier I requirements before or during the annual REC trading period. Because REC banking is limited to three years, the analysis never calls for purchasing more RECs than can be used during that time frame.

2. Broker quotes are compared to the Alternative Compliance Payment and budgeted REC prices to decide when to purchase RECs.

3. VPPSA may purchase smaller volumes of Tier I RECs toward the close of quarter 4 if prices are lower than budget.

WEC's heavy reliance on the sale of these RECs does pose a risk if those prices were to decline significantly. However, the alternative would be to not take advantage of the value the sale of those RECs can offer members currently. The Co-op does track changes in the REC market and in eligibility requirements. The pending legislation would impose on WEC the need to keep or acquire additional RECs to meet its load growth obligation, although the provision allowing additional 2 MW of HQUS power to count towards that obligation would help.

6.7 Capacity Acquisition Strategy

Capacity is seldom acquired as a standalone product, and because market prices are fixed by the Forward Capacity Market three years in advance of the operating year, there is little opportunity to make short-term (less than five year) capacity purchases. ISO-NE is on track to drastically change the capacity market to a prompt/seasonal market which is likely to alter WEC's capacity procurement strategy once the new market details are known. In the meantime, Coventry will have a significant impact on WEC's capacity obligations as a load reducer, as noted in Section 6.1.

Beyond purchasing capacity, there is short-term opportunity on the demand side. For example, VPPSA forecasts monthly and annual coincident peak demand, and communicates the forecast of the peak day and hour to WEC. WEC is considering using this information to help members avoid peak hours. In theory this would reduce WEC's load at peak, therefore reducing the capacity supply obligation. See more discussion of load management in the Innovation section.

6.8 Financial Analysis

This section quantifies the costs of a Reference Case and a series of resource procurement scenarios that would fulfill the existing RES requirement. It also includes a scenario that anticipates increased RES requirements to include a new renewable obligation for load growth above 2024 levels. These updated RES requirements are also based on Total Load Including Losses as opposed to retail sales. Finally, it also includes an analysis of battery storage to illustrate the cost-saving potential of a peak-shaving battery. The characteristics of these scenarios are summarized in Table 6-3.

6.8.1 Reference Case

The results of the Reference Case reflect the underlying trends in the price and volume of serving load. The Net Resource and Load Charges and Credits are growing at a 2.3% annual rate, which reflects the underlying assumptions for energy and capacity prices. Transmission charges are

Table 6-3. Scenarios

#	Resource Scenario	Description	Size	Price
0	Reference Case	RES 1.0 with NYPA extended through IRP period and no additional Takeback of HQ	N/A	DA LMP, Annual REC Value
1	HQ Takeback	Takeback remaining 2MW of HQ as appropriate based on Coverage Ratio	2MW	Contract Value
2	Expansion of Coventry	Installing additional units to increase generation by 50%	4MW	Fuel Contract Value
3	Battery Storage	One 4MW battery	N/A	Fixed Base Payment
4	New Version of RES	New Renewable Obligation for load growth. Obligations based on TLIL	N/A	Market Price of New Renewable RECs

Table 6-4. Reference Case Financial, Load, And Coverage Ratio Outcomes ($ Million)

Cost Item	2024	2028	2034	2038	2043	CAGR
Net Resource and Load Charges & Credits	$5.02	$5.34	$5.94	$6.48	$7.74	2.3%
Transmission Charges	$2.80	$2.88	$4.09	$5.26	$7.34	5.2%
Administrative and Other Charges & Credits	$0.16	$0.14	$0.21	$0.27	$0.33	4.1%
Total Charges	$7.97	$8.36	$10.25	$12.01	$15.41	3.5%
Total Load - Including Losses (MWH)	80,669	86,881	106,039	120,165	128,823	2.5%
Coverage Ratio	108%	100%	80%	69%	57%	

growing more quickly because this has been the trend over the past decade. Administrative costs grow slower than transmission costs, and the load itself grows at 2.5% per year after accounting for efficiency upgrades, electrification trends, and net metering. Finally, the coverage ratio drops as contracts expire and loads increase.

There are two primary strategies available to reduce the trend in these costs. To stabilize net resource costs, long-term, fixed price contracts can be entered at or below the embedded cost of the existing (or expiring) resource. Two options of this strategy are included in the scenario analysis: taking back the remaining 2 MW of HQ, and expanding the Coventry plant.

To reduce transmission costs, a peak-shaving storage resource is being studied. The system is presently sized at 4 MW. With a high degree of accuracy hitting the peaks, a battery would reduce transmission costs from present day costs due to lower coincident peaks. Expanding the Coventry plant would also reduce transmission costs, as the unit is going behind-the-meter in 2024. However, due to the year-on-year increase in transmission rates, the transmission costs likely wouldn't stabilize; instead, WEC's cost would be reduced from what the cost would have been without a battery or Coventry expansion. The next section quantifies the relative cost of each procurement scenario.

6.8.2 Procurement Scenarios

Table 6-5 shows the present value of the 20-year revenue requirement (PVRR) for the Reference Case and for the four procurement scenarios.

The HQ takeback scenario assumes WEC takes back the remaining 2 MW of the contract when WEC is contractually able to do so. WEC can take back as much as 1 MW starting in 2030 and the final 1 MW in 2032. This is the assumption of this first scenario. It decreases the Reference Case PVRR by $2.9 million, or 0.9%. The Coventry expansion is modeled assuming new capital expenditures and debt totaling $15 million, the price of power remains constant, and the capacity and output of the plant increases by 50%. This scenario decreases the Reference Case PVRR by $14.68 million, or 4.8%. The battery storage scenario has a fixed base payment with all revenue value going to WEC. It decreases the Reference Case PVRR by $3.98 million, or 1.3%. The fourth scenario is the cost of a new Renewable Energy Standard which requires incremental load above 2024 levels to be covered by new renewable resources as well as changing the definition of load to Total Load Including Losses, not simply retail sales. This increases the Reference Case PVRR by $8.99 million, or 2.9%.

6.8.3 Resource Conclusions

The financial analysis can be summarized as follows: WEC has three options to save or reduce future costs, with only one requiring significant capital expenditures, but still offering the potential for a reduction of future costs. First, WEC can choose to take back 2 MW of HQUS when it needs to receive the contracted power supply it is currently passing through to VEC. The takeback of this power resource will reduce costs by almost 1%. Second, the expansion at Coventry would reduce our costs by 4.8%, mostly due to the savings generated on transmission charges with Coventry becoming a load reducing power resource. Third, battery storage represents an opportunity to reduce costs by about 1.3% by mitigating the increasing cost of transmission and capacity as well as some other ancillary revenues. In any event, it is best practice to procure new resources using a competitive process, as outlined in the Resource Plan chapter. The cost-minimizing resource(s) will be sensitive

Table 6-5. Financial Outcomes Of Each Procurement Scenario ($ Million)

#	Procurement Scenario	PVRR	Unit	% Change
0	Reference Case	$306.05	PVRR	
1	HQ Takeback	$303.15	Change from Ref. Case	-0.9%
2	Coventry Expansion	$291.37	Change from Ref. Case	-4.8%
3	Battery Storage	$302.07	Change from Ref. Case	-1.3%
4	New RES	$315.04	Change from Ref. Case	2.9%

to energy, REC, and capacity market prices at the time of their procurement, and the size of each resource must align reasonably well with WEC's load to be an effective hedge against ISO-New England's day-ahead and real-time energy markets. Tier I RES requirements are currently being met with purchases of VT Tier I RECs to maintain our 100% renewability status, and we plan to continue this practice for the foreseeable future. WEC is exempt from Tier II requirements because it maintains 100% renewability. As WEC looks to determine future resource decisions, the organization will have to balance not being over reliant on a single source, like Coventry, with the inherent flexibility (and ever-changing market costs) of scalable energy storage, in order to find the right resource mix of time.

WEC's largest energy resource is the Coventry landfill gas to electricity plant. Increasing the number of generators at the plant will not only increase the energy generated but will help WEC with reducing peak demand due to electrification.

7. Regulatory and Legislative Mandates

Vermont electric utilities are under increasing pressure from politicians, advocates, and regulators to address broad societal problems, from climate change to racial and economic injustice.

As of this writing, the bill has been approved by the House of Representatives and is expected to pass the Senate this legislative session.

This bill, if put into law as currently drafted, would require most utilities to reach 100% renewability by 2030, and require the three currently 100% renewable utilities (WEC, Burlington Electric Department, and Swanton) to meet their load growth through new (post 2010) renewables on a set schedule. The bill would also largely eliminate group net metering, which would be a beneficial change for WEC. It would allow WEC's remaining 2 MW of HQ power to count towards its load growth obligation if WEC were to cease passing it through to VEC by 2028.

This bill, if enacted, would also change how renewability is measured. Rather than being based on retail sales, the amendments say total power usage by the utility, including line losses and uses by the utility itself, would need to meet renewability standards.

Overall, this bill as currently written is a slight improvement on the status quo from WEC's perspective. However, the legislation is another example of lawmakers' and regulators' refusal or inability to comprehensively review and modernize Vermont's net metering program to bring costs to non-net metering ratepayers in line with the benefits of the power produced.

WEC, with its 100% renewable energy portfolio, is well positioned to meet various goals and targets both in Act 56 and the state's Comprehensive Energy Plan (CEP). WEC has met the RES 55% renewable goals for 2022 and 2023 (Tier 1). More significantly, WEC has already exceeded the state goal of 75% renewable by 2032 with its existing (2023) mix of energy sources. WEC is a leader in renewable energy and one of only a few utilities in the nation that can boast a 100% renewable power supply mix. Therefore, WEC does not need to change or plan for new sources of power to meet the state's RES Tier I requirement.

Tier II requires electric providers to have distributed renewable generation comprising at least 1% of its annual retail sales for the year beginning January 1, 2017, and thereafter increasing by two-thirds percent each year for 10 years.

WEC's renewable determination by the PUC enables WEC to satisfy Tier II requirements by accepting net metering systems within its service territory. WEC is relieved of the requirement to take Standard Offer projects due to its 100% renewable status. WEC is still required to take its share of the power from the Ryegate wood to electricity project. If the Ryegate contract were terminated early due to failure to meet the efficiency requirements, the Co-op would very likely be able to replace this power at the same or lower cost with similar attributes.

Tier III aims to reduce fossil fuel consumption by electric utility customers through efforts that switch members away from fossil fuels in transportation and heating. All utilities were required to create a plan to meet their Tier III obligations, although the statute allows flexibility in how they meet their targets and does not mandate any particular product or service.

WEC's Annual Tier III Plan was filed with the PUC in November 2023 and addresses its strategy to meet Tier III compliance obligation for 2024. WEC offered a suite of energy transformation measures that have been screened and vetted through the Technical Advisory Group (TAG) screening process. A fundamental component of WEC's plan is to emphasize and match TAG screened measures with heightened weatherization efforts.

WEC closely coordinates with Vermont Energy Investment Corporation (VEIC) as the administrator of Efficiency Vermont, the statewide energy efficiency utility (EEU), to implement the Tier III programs. In addition, coordination of data collection, management, reporting, and evaluation and verification activities was maximized to the extent possible with protocols and schedules already in place for WEC and Efficiency Vermont.

7.1 GWSA/CAP

In 2020, the Vermont Legislature passed the Global Warming Solutions Act (GWSA; Act 153). This law created legally binding emission reduction targets. In December 2021, the Vermont Climate Council issued the Climate Action Plan (CAP) in accordance with the Act. The CAP calls for meeting 100% of the electricity sector needs from carbon-free or renewable resources.

7.2 EJA

In 2022, the Legislature passed Act 154, known as the Environmental Justice Act (EJA). The goal of the Environmental Justice Law is to ensure that all Vermonters, regardless of race, cultural background, or income, have equitable access to environmental benefits such as clean air and water, healthy food, and public transportation.

The PUC has said it will consider the goals, objectives, and requirements of the EJA as it reviews the next iteration of long-range planning documents, including IRPs.

Equity was a core cooperative principle long before the passage of Act 154.

The Co-op believes that ensuring environmental justice for its members also means addressing the impacts of income disparities and reducing energy burdens for the most disadvantaged in our communities.

To this end, Washington Electric Cooperative participates with Vermont Electric Cooperative in the Affordable Community Renewable Energy (ACRE) program. Although final approval is still pending at the Department of Public Service (DPS), this program will target low-income Vermonters through community renewable energy projects.

Funded by the American Rescue Plan (ARPA), the ACRE program aims to deliver both immediate and long-term benefits, including environmental benefits by reducing greenhouse gas emissions. It will also provide significant and meaningful rate relief to a portion of WEC's low-income members. It is expected that the program will be jointly administered with VEC and will provide a roughly $45 a month discount to as many as 240 income-qualifying WEC households for five years.

7.3 Low-Income Subsidization

In addition to the ACRE Program, WEC has other initiatives to assist low-income members by reducing their energy burdens. WEC is the only utility in Vermont that includes weatherization as part of its Tier III offerings for income-qualifying members. Weatherization has been offered since 2018 and is an ongoing program. While all Tier III incentives are designed to reduce members' use of fossil fuels, most of these incentives also benefit the utility because the incentives increase use of electricity. WEC's Weatherization Assistance Program is unique because it not only reduces fossil fuel use, but also increases the efficiency with which WEC members use electricity. While this may reduce the financial benefit of the measure for WEC as a distribution utility, it is in keeping with WEC's mission of encouraging both beneficial electrification and efficient use of electricity.

WEC also obtained and administered three grants from the Vermont Low Income Trust for Electricity (VLITE), the public benefit, nonprofit corporation formed and funded as a result of the 2012 merger by Vermont's investor-owned utilities. A 2019 VLITE grant of $80,000 was used to provide electric vehicle and plug-in hybrid electric vehicle incentives to income-eligible WEC members. WEC will continue efforts to obtain VLITE grants as part of ongoing work to assist its low-income members.

The most recent grant WEC obtained from VLITE will fund ReWire—a program that will pay for upgrading the electric service entrances of income-qualified members. These upgrades will allow these members to take advantage of beneficial electrification technologies that would otherwise be unavailable to them. This $100,000 grant was obtained in 2022. ReWire is about to be implemented and is expected to run through 2025. WEC's ReWire program is in partnership with Capstone. Notably, WEC has a long and consistent history of working with Capstone to provide WEC's low-income members with services such as ReWire, weatherization, and thermal projects. WEC fully expects to continue its partnership with Capstone with future projects.

WEC is also developing a tariff allowing it to join the Weatherization Repayment Assistance Program (WRAP.) This program allows on-bill financing of weatherization projects for members for whom the upfront cost of such an effort is a barrier, but who do not qualify for income-based weatherization assistance.

WEC also actively pursues federal funding which would assist its members, including federal grants, which could reduce the cost of needed upgrades to its substations and distribution infrastructure, and fund utility scale batteries. While the benefit of these grant funds is not specific to WEC's low-income members, reductions in capital costs avoid having to support these upgrades through rates. WEC is also actively seeking any grant funding opportunities which could directly benefit its low-income members as well, although its early adoption of a 100% renewable power portfolio makes successful application to some federal

programs designed to increase cooperatives' share of renewable power a challenge.

WEC is also developing and will petition for approval of a tariff to recoup costs attributable to Transmission Ground Fault Overvoltage (TGFOV) and related impacts of distributed generation. Presently, these costs are borne by WEC's overall membership. This inequity is disproportionately borne by WEC's low-income members. WEC's proposed tariff will be designed to limit this cost shift and lessen inequities.

Lastly, WEC's Community Fund is a longtime commitment to assist low-income members. Created in 2003, the Community Fund is funded through retired capital credits donated by members and other donations [see Section 1]. The Community Fund provides donations to non-profits and charities that provide services in WEC's service territory, in particular those providing basic services such as health care, food, and shelter.

7.4 AHA

Another regulatory mandate that will affect WEC's load and energy forecasts came in 2023, when the Legislature overrode Gov. Phil Scott's veto and passed the Affordable Heat Act.

The law requires companies that bring fossil fuels into Vermont to offset their sales of heating fuels by obtaining clean heat credits. The more fossil fuels a company brings in, the more clean-heat credits it must earn. A local fuel dealer could earn clean heat credits by helping Vermonters switch their heating systems from fossil fuel-powered systems to cleaner systems like cold climate heat pumps, geothermal, or heat pump water heaters. Like WEC's work under the Tier III provisions of the RES, it's expected that the Affordable Heat Act will accelerate even greater use of heat pumps in WEC's territory. WEC does not have an estimate of how precisely this law will impact WEC's obligation to serve future load.

7.5 Net Metering Challenges

Meanwhile, an earlier renewable mandate, the net metering program, has increasingly burdened Co-op members due to cost shifts, higher rates, and infrastructure upgrades needed to accommodate the excess distributed generation. [See Section 1.]

Net metering now adds about 5.6% to members' rates, after its benefits—including load reduction and transmission savings—are subtracted.

WEC believes the economic structure of net metering as it currently stands allows ratepayers with the means and upfront capital to install net metered systems to incur private economic benefit at the expense of publicly shared assets like the grid and our cooperatively owned utility.

WEC has for years provided 100% renewable power to its members. Our board and a majority of our member-owners believe strongly that all Vermonters should have access to 100% renewable, low-carbon electricity as soon as practical.

In the interests of WEC's environmental and social goals for its members and the communities we serve, we also believe that the renewable energy that Vermonters use should be provided at the lowest feasible cost to facilitate a viable transition to renewable power for heating and transportation, and to avoid unnecessarily burdening those Vermonters who are struggling financially.

The Public Utility Commission (PUC), in its biennial update of the net metering program, was quite clear net metering continues to be "one of the highest-cost sources of new renewable capacity in Vermont." The Commission said it "remains concerned about the overall cost of the net-metering program and its corresponding impact on non-participating Vermonters, particularly those Vermonters who are highly energy-burdened." [Case No. 22-0334-INV In re: biennial update of the net-metering program. Order Entered: 06/17/2022.]

The transportation and heating sectors each account for about 36% of Vermonters' carbon emissions, while the entire electric sector is only responsible for about 2%. To cut carbon emissions, we must focus our public policies on directly addressing impediments to decarbonizing heating and transportation in Vermont.

The PUC in its biennial update has acknowledged that its recent changes to net metering represent "only a modest decrease in compensation."

WEC will continue to advocate for a policy change that will allow those who wish to develop net metering systems to do so, without causing financial harm to their neighbors. WEC believes the Legislature should direct the PUC to alter the compensation for excess generation from net metering to be set at a utility's avoided costs. This would mean that the non-net metering ratepayers of a utility pay for excess net metering generation at the value that power actually provides at the time.

7.6 Transformer Upgrades: The Cooperative Approach

WEC understands that it would be rational to socialize the costs of transformer upgrades using a purely cost-benefit approach. If the Co-op were a for-profit utility that would indeed make sense, in part because those costs be recovered from customers as the rate base expands. Although we have not done a cost-benefit analysis, we expect that it would bear out that socialization of transformer costs would financially benefit the Co-op's bottom line by increasing sales of and encouraging members to expand their use of electricity for a variety of uses.

However, the Co-op was not formed to make money for investors. We are not running that kind of business. As a member-owned cooperative committed to equity principles, WEC follows the policy of requiring the member who causes an increase in load to pay for upgrades to directly handle that load when those upgrades necessitate a transformer above a base transformer size. This can occur when new transformers are needed for a net metering system, heat pumps, or any modification—such as installing equipment for a machine shop, for example—that leads to an increase in load.

This policy also applies to any damage to infrastructure—such as blown fuses in overloaded transformers—caused by an increase in load. This adheres to the Vermont Utilities Service Manual which says in relevant part:

> *"The customer shall give proper notice to the Utility of any substantial increase or decrease proposed in the connected load, or of any proposed changes in characteristics, purposes of use, or location of load. Failure on the part of the customer to give notice as provided above shall render them liable for any damages to meters, transformers, wires and associated apparatus of the utility, resulting from the increased or changed load."*
>
> – Sec. 205 Vermont Utilities Service Manual

Therefore, in order to follow equity principles, the Co-op will continue to seek cost recovery from those members who have made decisions that will require investment in infrastructure that would otherwise not be needed.

7.7 Reporting and Regulatory Requirements: Demands on a Small Utility

WEC faces a significant amount of regulatory work to comply with mandates from multiple state and federal agencies overseeing various aspects of our work. The General Manager, Director of Finance and Administration, Director of Engineering and Operations, the Director of Products and Services, and the Members Services Supervisor, and those who work for them, all devote a large share of their time to regulatory compliance. This is also true for the work the Co-op's outside legal counsel and its power supply consultants at Vermont Public Power Supply Authority do on WEC's behalf.

Here is a partial list of the utility regulatory processes WEC has been required to participate in over the last three years:

- Integrated Resource Plan
- two rate cases
- a rate design case and compliance with its ongoing conditions
- electric vehicle tariff docket
- several cases related to the Sheffield-Highgate Export Interface,
- dockets for those net metering systems installed in WEC territory
- contested case involving a group net metering project
- several consumer complaint investigations
- a low-income rate investigation
- a storm response investigation
- rulemaking procedures related to net metering, interconnection, pole attachment, disconnection procedural rules
- two disconnection moratoriums

In addition to the above are the annual reporting requirements including:

- Service Quality and Reliability (annually and quarterly)
- the System Reliability Report
- various net metering reporting requirements
- Renewable Energy Standard compliance reporting requirements
- 100% renewable designation filings

None of this includes WEC's obligations to report to state environmental agencies for various work it does to generate and provide renewable power to its members, from operation of the Wrightsville Hydroelectric Facility to underground storage and waste transportation permits, and the operation of the Coventry landfill gas plant. We also have a right-of-way maintenance report, and an annual report to allow calculation of the rate for the state's efficiency utility.

This list also does not cover the Co-op's obligations to the Federal Energy Regulatory Commission, to ISO-NE, or to its federal and private lenders, all of which are considerable.

8. Transmission and Distribution

8.1 Introduction

In 2023, WEC completed a study of our Transmission and Distribution (T&D) system and developed a ten-year Long Range Plan (LRP) in accordance with the USDA Rural Utilities Services (RUS) requirements. This was a detailed and comprehensive study of WEC's T&D system, including the sub-transmission lines that serve the distribution substations. A condensed summary of the Long Range Plan and T&D Assessment for this IRP is attached in the Appendix.

This study analyzed WEC's T&D system as it currently exists and also considered a ten-year planning horizon, accounting for anticipated increases in load and distributed generation. Through the course of the study, it became apparent that the WEC T&D system will be facing some unprecedented challenges in the coming years. Due to increasing electrification, from measures such as electric vehicle chargers and heat pumps, and the addition of new members, WEC is now experiencing significant load growth along with a high rate of Distributed Energy Resource (DER) deployment.

WEC is shifting from having to upgrade equipment from a purely asset-based perspective to considering the implications of significant load growth. Enhancing the connectivity and strengthening the ties between the distribution circuits will be key to increasing flexibility, not just from a reliability perspective, but also to address the unprecedented growth of the new load.

As will be summarized below and detailed in the Appendix, T&D upgrades required in year zero through year four are being driven by a combination of factors, including increases in beneficial electrification technologies, the addition of new members, increases in net metered solar, and to bring two substations up to modern standards with steel construction. As articulated in Case #23-3607-PET, WEC does not believe that an EV or whole-home TOD rate alone would be sufficient to avoid these impending infrastructure investments, and absent EVs altogether, these upgrades would still be necessary. WEC is working diligently, as described in Section 5.2, to implement a stop-gap approach to EV load management via the PowerShift program with plans to implement a whole-home TOD rate once the AMI upgrade project is complete in the coming years. Additionally, WEC is actively considering different battery storage options in an attempt to share in the value of reducing peak demand with members.

Reliability remains a chief concern for both WEC and its members. In order to continue to provide safe and reliable service while accommodating the increases in load and distributed generation, WEC's T&D system must be made stronger and more resilient with greater redundancy and connectivity. These needs are further emphasized by the increasing frequency of extreme weather events and the increase in damage to the T&D system WEC has been experiencing in recent years.

8.2 Substation Upgrades

WEC has eight distribution substations and one distribution primary metering point fed by another utility, all which were thermally evaluated in the 2023 Long Range Planning Study.

Analysis was done for two load scenarios: Peak with no DER output, and Minimum loads with full DER output, and it was determined that the following substation thermal limits are close to being exceeded:

- **#3 Mount Knox – Bus Regulators** – 150A
  - Due to peak loads

- **#8 Jackson Corners – (1) Transformer Bank** – 3,750 kVA
  - Due to peak loads
  - Due to minimum load with full DER output (reverse power)

  Critical: For the Jackson Corners #8 substation, it was determined that the 3,750 kVA substation transformer is nearing its thermal limit due to the total amount of distributed generation on all three distribution feeders, and no additional DERs can be allowed to interconnect until this substation is upgraded.

The support structures at both the Mt. Knox and Jackson Corners substations are of wooden design and will be replaced with all new steel structures. Mt. Knox was built in 1971 and Jackson Corners was built in 1968, and many of the wooden poles, crossarms, and equipment supports are showing signs of fatigue. WEC is currently working with an engineering firm to design replacement substations with a goal of completing both projects by 2027. While WEC is proceeding towards implementing a net metering tariff that would help it recoup costs for installing Transmission Ground Fault Overvoltage protections at others of its substations, it would be difficult or impossible to assign costs for the Jackson Corner upgrade to distributed generation. First, because the largest contributors are two standard offer projects which WEC provides with transmission service but does not utilize power from and which are already built, and second because determining

what portion of the upgrade is necessitated by aging infrastructure and load and which is due to distributed generation would be very difficult.

Two other substations, Moretown #9 substation and East Montpelier #1 substation, are both anticipated to reach thermal limits in the four-year and ten-year time frames:

- **#9 Moretown Substation Transformer Bank** – (3) – 1,250 kVA
  To ensure the substation's infrastructure is sized to serve the loads forecasted in the next 10 years and provide feeder backup capacity, the following are recommended:

- #**9 Moretown** – Recommendation Item #59
  - Replace substation transformer – 7.5/10.5 MVA

- **#1 East Montpelier Substation Transformer Bank** – (3) – 1,667 kVA
  To ensure the substation's infrastructure is sized to serve the loads forecasted in the next 10 years and provide feeder backup capacity, the following are recommended:

- **#1 East Montpelier** – Recommendation Item #63
  - Replace substation transformer – 7.5/10.5 MVA
  After the designs for the substation rebuilds and upgrades are completed, WEC will file an amendment to the 2024-2027 CWP for funding to complete the four substation projects.

8.3 TGOV Transmission Ground Fault Overvoltage

WEC, like many utilities, has enough aggregate small DER on its distribution system that Transmission Ground Fault Overvoltage (TGFOV) can be a concern. Essentially, without enough load to suppress the DER output, an overvoltage can occur on the sub-transmission system during a line-to-ground fault that the DER cannot sense due to the substation transformer configuration high side delta, low side grounded-wye.

The WEC distribution substations' Load to Generation Ratios (LGR) are shown in the table below. An LGR of less than two shows a risk of a damaging TGFOV event. Based on the results below, all the WEC distribution substations should have TGFOV protection installed to prevent damaging overvoltages from occurring on the sub-transmission lines. Some circuits already have TGFOV protection, and these are shown in Table 8-1 as well.

The best protection scheme for each substation is still under review, but most likely will consist of a communications-based scheme or a set of voltage-sensing transformers installed on the high voltage side of the substation that will trip the circuit reclosers and prevent the DER from backfeeding on to the sub-transmission line during a fault.

WEC's consulting engineer doing the substation rebuild designs will also be tasked with completing TGFOV solutions for the remaining six WEC substations. Funding for those six solutions has already been accounted for in the 2024-27 CWP.

8.4 System Upgrades: Voltage Issues, Phase Balancing, Three-Phase Extensions

Over the last 25 years, WEC has been adhering to USDA Rural Utility Services (RUS) construction standards that help harden the distribution system from the effects of increased storm severity. These practices are funded through the RUS approved Construction Work Plan (CWP) process. The four-year CWP is focused on continued improvement and enhanced reliability of WEC's transmission and distribution system.

Over the last 10 years, 100% of WEC's pole plant has been inspected and WEC continues to inspect 10% of

Table 8-1. Substation Upgrades

Substation	Min Load kW	Connected Generation kW	Pending Generation kW	Total DER kW	Net Power kW	LGR If <2 TGFOV Protection Required	TGFOV required?
1 - East Montpelier	339.11	3325.4	115.52	3440.92	-3101.81	0.099	Yes
3 - Mount Knox	624.00	671.95	65.2	737.15	-113.15	0.847	Yes
4 - W Danville	141.00	168.3	23.9	192.2	-51.20	0.734	Yes
5 - S. Walden	267.00	474.3	64.79	539.09	-272.09	0.495	Yes
8 - Jackson Corners	1042.8	4756.9	103.13	4860.03	-3817.23	0.215	Yes
9 - Moretown[7]	871.70	2985.4	367	3352.4	-2480.70	0.260	Yes
10 - Maple Corners	101.29	660.85	105.6	766.45	-665.16	0.132	Yes
11 - Tunbridge	503.00	559.8	197.9	757.7	-254.70	0.664	Yes

7 The #1 Middlesex and #3 Fayston and Middlesex circuits already have TGFOV protection. The #2 Moretown Common circuit needs to be included in the scheme.

the plant each year as required by RUS standards. WEC has also recently conducted an inspection of all primary underground installations to ensure they meet RUS and NESC requirements and present no inherent safety or reliability issues. The results of these inspections are used to assess the current condition of WEC's pole plant to maximize their life cycle value. The inspection data is crucial in determining pole condition, and the results are fully integrated into the WEC's four-year CWP. During the 2019-22 CWP work period, WEC replaced and/or installed a total of 1,071 poles. Also in 2022, WEC moved away from using Class 3 pole sizes and started replacing poles with a stronger, thicker Class 2 pole to provide added protection against falling trees.

In 2021, WEC began using all CCA treated poles with climbing additive when building new line or replacing damaged or aging poles. While other treatments may prove their worth, they do not yet have the track record warranting adoption yet. WEC sends all old Penta treated poles to a lined landfill.

In 2023, WEC's consulting engineering group completed a system wide study to develop a 10-year long-range plan (LRP) to determine the immediate and long-term distribution system requirements through the year 2033. The study reviewed all of WEC's distribution substations, distribution lines, and transmission lines; and evaluations included thermal, voltage, reverse power, reactive compensation, short circuit, asset condition, reliability, and operational considerations based on historical load and load growth projections over the next 10 years. The evaluations determined a list of short- and long-term recommendations that WEC will incorporate into its new 2024-2027 CWP and subsequent CWPs through 2034.

The new 2024-2027 CWP calls for approximately 75% of the dollars being spent on reconstruction and upgrades on circuits in WEC's service territory. The CWP also outlines system-hardening improvements including, but not limited to, the following: replacement of small and aged conductors, installation of capacitors to reduce line loss, the replacement of deteriorated poles, the addition of mid-span poles to reduce conductor span lengths and the reconstruction of approximately 14 miles of line.

Upgrades and system enhancements in the new 2024-2027 CWP include a complete AMI system replacement, installation of Transmission Ground Fault Overvoltage (TGFOV) protection at six substations, installation and/or upgrades of 24 new reclosers, installation and/or replacement of approximately 750 distribution transformers, installation of new voltage regulators and capacitors, upgrades at two substations, and the complete replacement of two other substations. WEC anticipates paying for its AMI project through state and federal grants, and through USDA RUS loan funds. WEC is also working on a net metering tariff which would include a charge on such projects to recoup the costs of TGFOV protection installation.

In addition to the above CWP projects, 14 line rehabilitation projects were identified and added to the new plan, two of which will extend three-phase conductors on two feeders beyond their current end points to help with phase balancing, voltage control, and outage management by further segmenting long, single-phase lines. A third three-phase project was created from the December 2022 winter storm that was eligible as a FEMA event. FEMA will provide mitigation funding for this project, where an off-road section of this three-phase line was heavily damaged during that storm.

The mitigation plan will replace 46 old class 4, 5, and 6 poles with taller class 2 poles, relocate an off-road section of the line to the road and replace older, smaller conductors with the stronger Cable Spacer System. The Cable Spacer System's compact design shrinks the strike zone from falling trees and uses a support messenger to support the insulated conductors. This system is better suited to keeping the conductors in the air and energized when struck by a falling tree. It will be used for all applicable three-phase upgrade projects in the future for added reliability. WEC also reviews all single-phase upgrade projects to determine if they should be upgraded in place, moved to the road, or converted to underground. A number of factors come into this consideration, including the number of members served and benefit from an outage perspective, the difficulty of servicing these lines where they are, the ability to obtain easements allowing these lines to be moved and costs of doing so.

WEC continues the practice of conducting annual inspections of its entire 34.5 kV and 46 kV transmission lines in the spring and fall of each year. An infrared hot spot scan of equipment and equipment connections within the substations is also completed. During the 2019-22 CWP period, WEC completed upgrades on the Graniteville to Jackson Corners 34.5 kV transmission line and installed a new 34.5 kV switch at the Mt. Knox substation. WEC also completed 65% of the upgrades on the South Walden 34.5 kV transmission line during the last CWP work period. In the upcoming 2024-2027 CWP, WEC plans on completing the upgrades on the South Walden 34.5 kV line and adding a new recloser at the GMP/WEC tap location.

8.5 AMI Upgrades

Included in the 2024-2027 CWP are plans to convert WEC's existing Power Line Carrier (PLC) AMI system with a new RF-Mesh AMI system due to the limited ability of the PLC metering system. Interference, caused by other technologies such as heat pumps and DC inverters in net metering locations, limits how much data it can carry, and hinders the WEC operations group from properly identifying outage locations and restorations.

8.6 Reliability and Outage Response

Washington Electric Cooperative served an average of 11,527 members in 2023 via an electrical distribution system that includes 26 miles of WEC-owned transmission line and 1,266 miles of distribution line. The system includes eight distribution substations, seven of which depend on a third-party transmission provider (Green Mountain Power)

for service. The remaining substation is served via a WEC owned transmission line interconnected to Vermont Electric Power Company's (VELCO) high voltage substation in Chelsea, VT. (WEC's complete 2023 System Reliability Report is located in the Appendix.)

WEC's distribution lines are located throughout 41 towns in Central Vermont, covering approximately 2,728 square miles and serve remote locations composed of rural homes, small farms and small businesses. There are approximately eight service locations per mile of line, many of which are located on unpaved roads in small valleys within the 41 towns.

WEC's distribution system was constructed during a time when much of the land was open fields and pasture and has since grown in. Vermont lies within a biological transition zone between the northern boreal forest to the southern deciduous forests. The northern hardwood mix of beech, birch, and maple dominates Vermont's forests, accounting for 71% of the forest cover. The remote location of the lines and abundance of fast-growing species such as red maple, poplar, and white birch, coupled with severe weather events, significantly increases the exposure of the lines to tree-related outages which can only be combated through hardening of the lines and increased maintenance clearing.

The System Average Interruption Frequency Index (SAIFI) and the Customer Average Interruption Duration Index (CAIDI) performance measure targets established in WEC's Successor Service Quality and Reliability Plan are 3.8 and 2.7 respectively. The SAIFI and CAIDI indices for 2023, exclusive of major storms, were 2.8 and 3.2 respectively. The SAIFI and CAIDI indices, exclusive of major storms, have averaged 2.8 and 3.4 over the last three years, and the 10-year averages are 2.9 and 2.8 respectively.

In 2023, WEC experienced 787 separate outages, exclusive of major storms, on the distribution system compared to 843 in 2022. The rolling three-year average for total number of outages, exclusive of major storms, is 835, and the rolling 10-year average is 753. The total number of consumer-hours-out in 2023, exclusive of major storms, was 103,876 compared to 145,304 in 2022. The rolling three-year average of consumer-hours-out, exclusive of major storms, is 111,220, and the 10-year rolling average is 89,264.

During 2023, WEC experienced five severe weather events that met the criteria for Major Storm. These major weather events include the three back-to-back storms cited in Section 2.8 as a potential portent of the more severe and frequent storms likely to hit WEC's territory due to climate change. Major Storms are defined in WEC's Successor Service Quality and Reliability Performance Plan as:

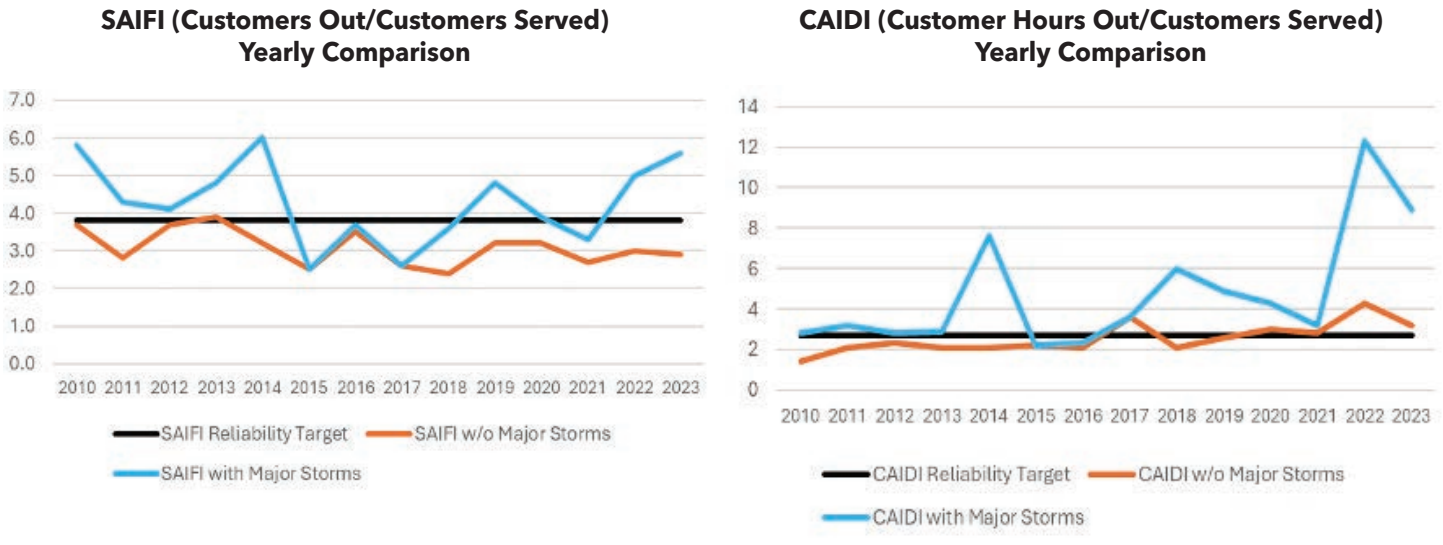
1. Extensive mechanical damage to the utility infrastructure has occurred;
2. More than 10% of the customers in a service territory are out of service due to the storm or the storm effects; and
3. At least 1% of the customers in the service territory are out of service for at least 24 hours.

In total, these five major storms almost doubled the number of outages WEC experienced in 2023, with an additional 662 outage events involving 29,294 customers out, and 441,839 customer-hours-out.

Three extreme weather events consisting of wet, heavy snow loading during the April 19 and December 16 storms, and a severe wind event with winds 50-plus miles per hour during the December 2023 storm caused widespread and severe damage to WEC's distribution infrastructure. In all three major storm events, the primary cause of outages was tree contact. During the December 23 storm, WEC received 6,560 calls from members without power and hundreds of reports of trees on lines and lines down. Forty broken poles were discovered and replaced during the restoration process. At one point, WEC had over 60 people from outside mutual aid crews working to restore power to more than 5,000 members.

Storm Response: WEC monitors the weather on a daily basis, and when notification of an approaching severe weather event is received from VELCO weather forecasters, WEC participates in the VELCO emergency prep conference

Figure 8-1. SAIFI and CAIDI Indices



calls for these events.

WEC personnel are put on alert ahead of all weather events that are flagged as potential outage generator situations, and preparations are made ahead of the event to coordinate deployment of resources and restoration. WEC also utilizes the NEPPA Mutual Aid program for Major Storm restoration, and depending on the type and amount of damage that occurs, WEC will request any needed resources from NEPPA, WEC line contractors, and other Vermont utilities to expedite restoration.

Outage Management: WEC utilizes NISC's outage management software to record and manage outages. The system today relies solely on member phone calls to report outages to predict outage location and determine protective devices.

In 2023, WEC made several changes internally to the way outages are managed. Working with our OMS software vendor, WEC changed the way our online outage map displays outage information. Members can now see if their general location is affected by an outage or is part of a larger outage. By hovering over the outage point on the map, information regarding the outage (i.e., when reported, when crews are assigned, cause and estimated restoration time) can be displayed. Also in 2023, WEC deployed tablets to our line crews who now have the ability to view all outage information, including any information regarding the outage called in by members.

8.7 Vegetation Management

For the last five years and again for 2024, WEC's Board of Directors has approved significant funding for right-of-way (ROW) clearing. [See complete vegetation management plan in the Appendix.] The funding will be used to target clearing those lines directly affected by wet snow loading and danger trees. During 2023, ROW clearing crews maintained approximately 67 miles of distribution line and 1.16 miles of transmission line. A total of 4,326 danger trees were cut during ROW operations.

In 2023, WEC conducted a study of tree outages over the 2017-2022 six-year period to determine which substations and distribution circuits were the worst performers. Individual circuits were evaluated down to the fuse level to identify those sections of line with a higher frequency of outages. WEC plans on utilizing the results of this study

by combining this information with new emerging AI technologies, satellite imagery, and other system information to develop a new cutting plan in 2024. WEC's pole, line and substation locations are included in our GIS system. The system is working adequately for our needs.

The Emerald Ash Borer is a continued threat to service reliability. In 2018, the Emerald Ash Borer (EAB) was detected in Orange County, which is the heart of WEC's service territory. The EAB is an insect of Asiatic origin that bores into the ash tree and lays eggs. The resulting larvae feed off the soft tissue of the tree below the bark, effectively girdling the tree and cutting off the flow of water and nutrients to the tree's canopy, killing the tree. Based on experience in other states, the EAB is expected to devastate most ash trees located within any infected area. Historically, utilities have purposely left the ash tree to populate along and adjacent to electric line corridors as it was a hardy and resilient species. Unfortunately, the ash trees once infected with the EAB are expected to be dead within two to four years and hence become a significant threat to electric lines, and therefore service reliability. Ash trees are prioritized by WEC ROW clearing crews while performing maintenance cutting in WEC rights-of-way.

The 2024 ROW clearing budget will fund a targeted distribution system trim cycle of just over eight years and a transmission trim cycle of approximately six years. The additional funding provided over the last four budget years was mostly allocated to WEC's three-phase main line feeders and danger tree removal on transmission, three-phase, and single-phase main line circuits.

Table 8-2. Line Clearing

	Total Miles		Miles Needing Trimming		Trimming Cycle (years)	
Sub-transmission	**25.4**		**10.5**		**6**	
Distribution	**1,233**		**801.5**		**8**	
	2021	**2022**	**2023**	**2024**	**2025**	**2026**
Amount Budgeted	$1,086,174	$1,118,759	$1,118,759	$1,230,635	$1,118,759	$1,118,759
Amount Spent	$1,138,076	$1,210,582	$1,092,364			
Miles Trimmed	82.6	79.4	66.7	110	110	110

9. Action Plan

9.1 Action Plan Summary

In the action plan below, the Co-op balances competing priorities to achieve a high-level goal: To provide reliable renewable power to its members at the lowest practical cost in a way that meets our members' environmental, social, and governance expectations. The ultimate use of an IRP is to guide and document a utility's decisions about investments in infrastructure and power supplies to meet these high-level goals and to meet the objectives of its owners, investors, and ratepayers, which in the case of a public power cooperative like WEC, are one and the same.

The Co-op will focus on several important objectives to fulfill its mission, although there is obviously overlap and interplay between them:

- **Renewable Power:** Maintaining a 100% renewable energy portfolio in a time of increasing demand
- **Financial Health:** Balancing investments with rates
- **Innovation:** Deploying modern utility infrastructure and equipment to aid reliability and speed decarbonization
- **Energy Equity:** Fairly distributing benefits and costs among WEC members
- **Grid Resiliency:** Maintaining a safe and reliable grid that can manage distributed generation and more severe weather damage

These guiding principles can appear to have competing priorities at times, but all were considered as WEC charted the action plans noted below.

9.2 Actions to Maintain Renewable Power Status

As one of three 100% renewable utilities in Vermont, WEC is committed to maintaining its green power portfolio. In a new era of expected load growth, that will necessitate the consideration of new potential power sources that meet those goals. As described in the Power Supply and Decision Analysis sections, WEC has contemplated many options to achieve its goals, and the following actions will be taken as a result:

- **WEC has begun using, instead of passing through to Vermont Electric Cooperative, 2 MW of power from HQUS. It is possible, perhaps even likely, that WEC will seek to utilize the other 2 MW of HQUS power in the coming years as load growth increases as noted above.** WEC will continue monitoring its coverage ratio and load growth and evaluating when it will be able to retain this additional power under its contracts and whether to do so. This may be complicated by potential legislative action to limit how HQUS power is treated in the Vermont regulatory system.
- WEC's contract for landfill gas to supply the Coventry plant continues for more than a decade. WEC has recently completed a major upgrade to the gas piping and management system at the plant and anticipates another major upgrade to the chiller (which cools the incoming gas) in the near term in order to maintain production. This site may also be able to produce more power for WEC members, depending of course on reaching an agreement with the landfill operator.
- The Wrightsville Hydroelectric project has recently been relicensed for a 40 year term by the Federal Energy Regulatory Commission. However, this is among the more expensive power for WEC, so consideration must be given as to how to make this operation more efficient and effective. WEC anticipates the need for a complete overhaul of the current computer control system at the project in order to maintain operations.
- While WEC has seen as rapid an expansion of net metering projects as anywhere in the state, the fact that most of this production is and is expected to remain solar power presents a challenge, given when WEC's peak periods occur. Deployment of battery storage at the home or substation level might help make this power more useful, an option which WEC is in the early stages of investigating.
- As large-scale renewable energy projects come online in New England, WEC will need to evaluate when to consider new long-term contracts. This will be even more important if legislation imposes a requirement for 100% renewable utilities to meet their load growth through "new" renewables.
- WEC's ability to sell Renewable Energy Certificates (RECs) from its own power sources and purchase less expensive RECs to ensure its portfolio remains renewable is important to its ability to maintain its energy portfolio requirements and to meet its financial needs. WEC will

continue monitoring legislative and regulatory changes inside Vermont and outside of it to prepare for any changes which might impact its ability to use RECs in this way, and will consider changes to how it manages its REC portfolio.

In the past, declines in the markets for RECs have prompted the need for rate increases. While REC prices have been and are expected to remain fairly stable, WEC and its consultants at VPPSA will continue monitoring these markets for RECs to prepare for any changes. Currently it is hard to imagine a change in how WEC approaches REC management that would not likely increase costs and rates for WEC members, but that may change.

9.3 Actions to Secure Financial Health

WEC has two central objectives in its financial management. First, to keep rate pressure on its members as low as practical while achieving its other goals. Second, to maintain its ability to meet the financial covenants with its lenders, first and foremost the USDA Rural Utilities Service. The impact on WEC's financial health has been considered throughout this IRP, and the resulting actions are the concrete streps WEC will take in this regard:

- WEC's various loan covenants with RUS require that the Co-op maintain a 1.25 times interest earned ratio (TIER) and an operating times interest earned ratio (OTIER) of 1.10 in the best two of three most recent years. While WEC is currently in compliance, **WEC will continue evaluating its margins to maintain the crucial ability to benefit from low-interest RUS borrowing.**

- WEC has also borrowed from the National Rural Utilities Cooperative Finance Corporation (CFC). Given that most of WEC's debt is with RUS, CFC has only required that the Co-op maintain its RUS covenants for current long-term debt obligations. However, if WEC were to borrow long-term debt again from CFC, it would likely need to meet a modified debt service coverage ratio (MDSC) of 1.35 or above. WEC will continue budgeting with an eye to meeting this requirement to maintain the ability to borrow from CFC, even though it is not required by the lender for current debt.

- WEC requested a significant rate increase in 2022 primarily due to power supply costs, which resulted in approval by the PUC of a 12.83% increase. This was obviously a significant rate hike for members to absorb. WEC does not anticipate another rate increase of such significance, but it is possible that **WEC will likely need to propose more modest rate increases in the short run given increases in costs of wages and materials, and the continued and growing financial impact of net metering participation.**

- As noted in Section 8.4, **WEC will continue to work with FEMA to ensure WEC obtains current and future mitigation funding, such as the funding we are awaiting final approval on for a three-phase project, where an off-road section of this three-phase line was heavily damaged during the December 2022 winter storm.** This funding, if approved, is critical to WEC's goal to keep rate pressures as limited as possible while striving to build resiliency in our infrastructure.

- When considering rate pressure, it is important to remember that WEC returns patronage capital from excess margins to its members. Since 1998 the Co-op has returned more than $9.5 million in such disbursements. While some of that money has, rightfully, been returned to former members, it represents a significant offset to rate increases for those who remain on WEC lines. The Co-op will continue to disburse such patronage capital annually provided equity levels and cash flow make doing so prudent.

9.4 Actions for Innovation

For a small, rural utility with growing expectations from its members and regulators and a large amount of net metering on its system, the adoption of new technology is essential to maintaining reliability and keeping rates as low as reasonably possible. This will take several forms, and it will take a number of years for WEC to catch up with what other utilities have done, but it is our intention to not only do that but gain and maintain a position at the forefront of these innovations, something we believe is a necessity.

- WEC currently has power line carrier based Advanced Metering Infrastructure (AMI) and is now developing a radio frequency-based AMI system. Based on communication with the Department of Public Service we anticipate $2.25 million in state grant funding to support this project, anticipated to cost roughly $5 million. The remaining funding will come from other grant opportunities or through Rural Utilities Service borrowing. WEC expects to solicit bids from vendors shortly. A modern AMI system will have several positive impacts for WEC. It will improve data quality and volume coming in from meters at member locations. This will enable quicker and more efficient restoration efforts during outages by providing additional data, allowing meters to communicate (at least once) beyond where there are breaks on WEC lines, and will mean we rely less on members informing us about outages in order to coordinate outage response. New meters will also allow us to gather data from meters which are now facing interference from net metering systems, underground lines, or heat pumps. Finally, and perhaps most importantly, these meters will allow us to effectively implement time-of-use rates and aid in enlisting members in managing WEC's power usage and demands. **WEC will work diligently over the next four years to construct and implement this important new AMI system.**

- Given the amount of distributed generation on WEC's system and the more than 1,300 miles of power lines we maintain over rugged territory which results in outages, including some of significant duration, WEC is in the early stages of considering how battery storage can be used in our territory. Whether that will involve utility scale batteries (likely at substations), member home-based batteries, or a combination depends on a variety of factors, including grant funding opportunities and potential partnerships. WEC has already been party to several grant applications, including two statewide applications overseen by the DPS. As noted in Section 5.6, WEC anticipates leveraging the Energy Storage Access Program (ESAP) grant funds, alongside its project partners, to "implement a common, multi-device, software solution for storage and flexible load management (FLM). **WEC will continue working on developing a strategy for adding battery energy storage to its system to assist with load/generation issues, potentially reduce the need for infrastructure investments, and help members deal with outages.** We will also continue joining or initiating grant applications seeking funding for these systems.

- As noted in case 23-3607-PET, **WEC will begin planning for a TOD rate that will allow members with EVs and battery energy storage systems to share in the value of flexible load management** – once the new AMI system is operational.

- Through a valuable partnership with VELCO, the transmission utility's fiber network has recently been extended to all of WEC's substations. This is already starting to provide important visibility into those substations, and we anticipate that it will continue to improve and expand this visibility, assisting in both day-to-day operations and also assist in outage response.

9.5 Actions to Achieve Energy Equity

As a cooperative, WEC is committed to treating its members as fairly as possible. That means expecting that members will share in covering the costs of providing electricity, maintaining the human and physical infrastructure to generate and deliver that electricity, and also that members will have as close to equal access as possible to the benefits provided by the utility. We are committed to continuing these principles to the extent possible even while navigating the rapidly and dramatically changing electrical utility landscape. Energy equity is at the forefront of WEC's priority list, and the following actions are evidence of this:

- Net metering under the current regulatory and statutory construct represents a significant cost shift among WEC members. While not universally the case, the in the aggregate this shift in costs is from wealthier members and wealthier portions of the territory onto those who are less well off and from towns that face higher energy burdens. **WEC will continue advocating for a net metering structure that moves towards an avoided cost basis, and as it contemplates changes will endeavor to move its rate structure to one that most fairly allocates benefits and costs. WEC is also developing and will petition for approval of a tariff to recoup costs attributable to transmission ground fault overvoltage (TGFOV) and related impacts of distributed generation to limit this cost shift and lessen inequities.** We will also continue to work towards opening access to the financial benefits of renewable power to those who cannot for various reasons participate directly in net metering, for instance by joining VEC in the state ACRE program and similar such grant-funded efforts.

- WEC has long been an advocate for and a participant in income-based programs both through the statewide energy efficiency utility and through its own Tier III efforts, and will continue to do so. **WEC remains concerned about disadvantages that WEC's income-qualified weatherization efforts with Capstone face compared to other Tier III measures, and will continue to advocate for changes to make weatherization a more viable measure.**

- We also believe that an income-based power bill subsidy program that is based on individual utility territories is a mistake and perpetuates inequalities that date back as far as the creation of these franchise territories themselves. Therefore, **WEC will continue to advocate for income-based power bill subsidy programs to be developed on a statewide basis.**

WEC does not and does not want to maintain member income or financial information, but uses third-parties in order to evaluate eligibility for income based programs. This makes internal tracking or measuring of efforts to set or evaluate goals for income-based equity goals difficult, but also protects member privacy and the relationship between members and their Co-op. The fairness of various WEC program and policies, and members' reaction to them, is a frequent discussion between Co-op staff, board and membership but has not been the subject of significant organized member engagement beyond the standard surveys.

9.6 Actions to Ensure Grid Resiliency

As stated in the T&D section, **WEC is prioritizing investments in the CWP that will result in resiliency of the grid.** Such system-hardening improvements include but are not limited to: replacement of small and aged conductors, installation of capacitors to reduce line loss, the replacement of deteriorated poles, the addition of mid-span poles to reduce conductor span lengths, and the reconstruction of approximately 14 miles of line.

Additionally, WEC is continuing to invest in vegetation management and ROW clearing, adding "tree-line" or other line technologies, undergrounding line sections

where appropriate, re-routing line sections closer to roads, installing additional reclosers to isolate outage issues, improving communications to members about outage restoration, and launching a new AMI project that will decrease outage hours across the territory. As noted previously, WEC is also pursuing funding options to encourage members to cost-effectively share in the benefits of home-based BESS.

9.7 Actions Related to Transmission and Distribution

As noted in the T&D section, WEC staff will undertake hundreds of individual projects over the duration of our 2024-2027 Construction Work Plan. These projects range from basic line upgrades to hundreds of transformer upgrades, to significant investments in our substations to accommodate the continued inundation of net metering solar and prepare for possible battery storage. **WEC anticipates following through with all activities identified in the CWP, as noted in the T&D section and as detailed in the CWP in the Appendix.**

9.8 Action Plan Recap

Rural electrical cooperatives like WEC exist because providing service in territories like ours is difficult and expensive. That remains just as true today as it was 85 years ago. However, by building modern utility technology and practices into our work and system, and by utilizing partnerships to make up for our small size, WEC can meet both its members needs from their power supplier and their expectations for how their power is produced and delivered.

Wrightsville Reservoir

Glossary of Acronyms

ACP . . . . . Alternative Compliance Payment
ACRE . . . . . Affordable Community Renewable Energy
AMI . . . . . Advanced Metering Infrastructure
ARPA. . . . . American Rescue Plan
ARRA . . . . . American Recovery and Reinvestment Act
BESS . . . . . Battery Energy Storage System
BMT . . . . . Behind the Meter
CAA . . . . . Clean Air Act
CAGR . . . . . Compound Annual Growth Rate
CCHP . . . . . Cold Climate Heat Pump
CDA . . . . . Central Dispatch Agreement
CEP . . . . . Comprehensive Energy Plan
CSO . . . . . Capacity Supply Obligation
CWP . . . . . Construction Work Plan
DER. . . . . Distributed Energy Resources
DPS . . . . . Department of Public Service
DSM . . . . . Demand Side Management
DUP. . . . . Distributed Utility Planning
EAN . . . . . Energy Action Network
EEU . . . . . Energy Efficiency Utility
EPA . . . . . Environmental Protection Agency
ESAP. . . . . Energy Storage Access Program
EVT . . . . . Efficiency Vermont
EV . . . . . Electric Vehicles
FCA. . . . . Forward Capacity Auction
FCM . . . . . Forward Capacity Market
FERC. . . . . Federal Energy Regulatory Commission
HQ B. . . . . Hydro-Québec Schedule B
HQUS PPA . . . . . Hydro-Québec US Purchase Power Agreement
HQ VJO . . . . . Hydro-Québec Vermont Joint Owner
ICAP . . . . . Installed Capacity
IRP. . . . . Integrated Resource Plan
ISO-NE . . . . . Independent System Operators of New England
LEAD. . . . . Low-Income Energy Affordability Data Tool
LFG . . . . . Landfill Gas
LMP. . . . . Locational Marginal Prices
LNG . . . . . Liquid Natural Gas
LSE . . . . . Load Serving Entity
NEMA. . . . . Northeast Massachusetts
NEPOOL GIS . . . New England Power Pool Generation Information System
NM . . . . . Net Metering
NEWSVT. . . . . New England Waste Services of Vermont Landfill
NPV. . . . . Net Present Value
NSPC . . . . . New Source Performance Standards
NYPA . . . . . New York Power Authority
PEV . . . . . Plug in Electric Vehicles
PUC. . . . . Public Utility Commission
PV . . . . . Present Value
RF . . . . . Radio Frequency
REC. . . . . Renewable Energy Credits
RGGI. . . . . Regional Greenhouse Gas Initiative
RNI . . . . . Regional Network Load costs
ROW. . . . . Right-of-Way
RPS . . . . . Renewable Portfolio Standard RUS Rural Utility Service
RTLO. . . . . Real-Time Load Obligation
SCADA. . . . . Supervisory Control and Data Acquisition
SHEI . . . . . Sheffield Highate Export Interface
SPEED . . . . . Sustainably Priced Energy Enterprise Development Program
TGFOV . . . . . Transmission Ground Fault Overvoltage
TOD . . . . . Time of Day (rate)
TOU . . . . . Time of Use
T & D. . . . . Transmission and Distribution
UCAP . . . . . Unforced Capacity
VEC. . . . . Vermont Electric Cooperative
VELCO . . . . . Vermont Electric Power Company
VEPPI . . . . . Vermont Electric Power Producers Inc.
VLITE. . . . . Vermont Low Income Trust for Electricity
VPPSA. . . . . Vermont Public Power Supply Authority
VSA . . . . . Vermont Statutes Annotated
VSPC. . . . . Vermont System Planning Committee
WEC . . . . . Washington Electric Cooperative

Appendix Summary

Appendix Section	Document Name
A	Memorandum of Understanding - 2020 IRP
B	Initiative Flow Charts, WEC
C	2023 Long-Term Demand Forecast Summary, Itron
D	2023 Vermont Energy Burden Report, Efficiency Vermont
E	2023 System Reliability Report, WEC
F	2024 Annual Plan for Tier III Compliance, WEC
G	Construction Work Plan 2024-2027, Control Point
H	Vegetation Management Plan, WEC
I	2020 Residential Member Satisfaction Survey, NRECA
J	Extreme Weather: Implications for the Electric Grid, Northview
K	Transmission & Distribution System Analysis, Control Point
L	Financial Base Case Reference File, WEC (Excel document)
M	Financial Model Scenario 1, WEC (Excel document)
N	Financial Model Scenario 2, WEC (Excel document)
O	Financial Model Scenario 3, WEC (Excel document)
P	Financial Model Scenario 4, WEC (Excel document)